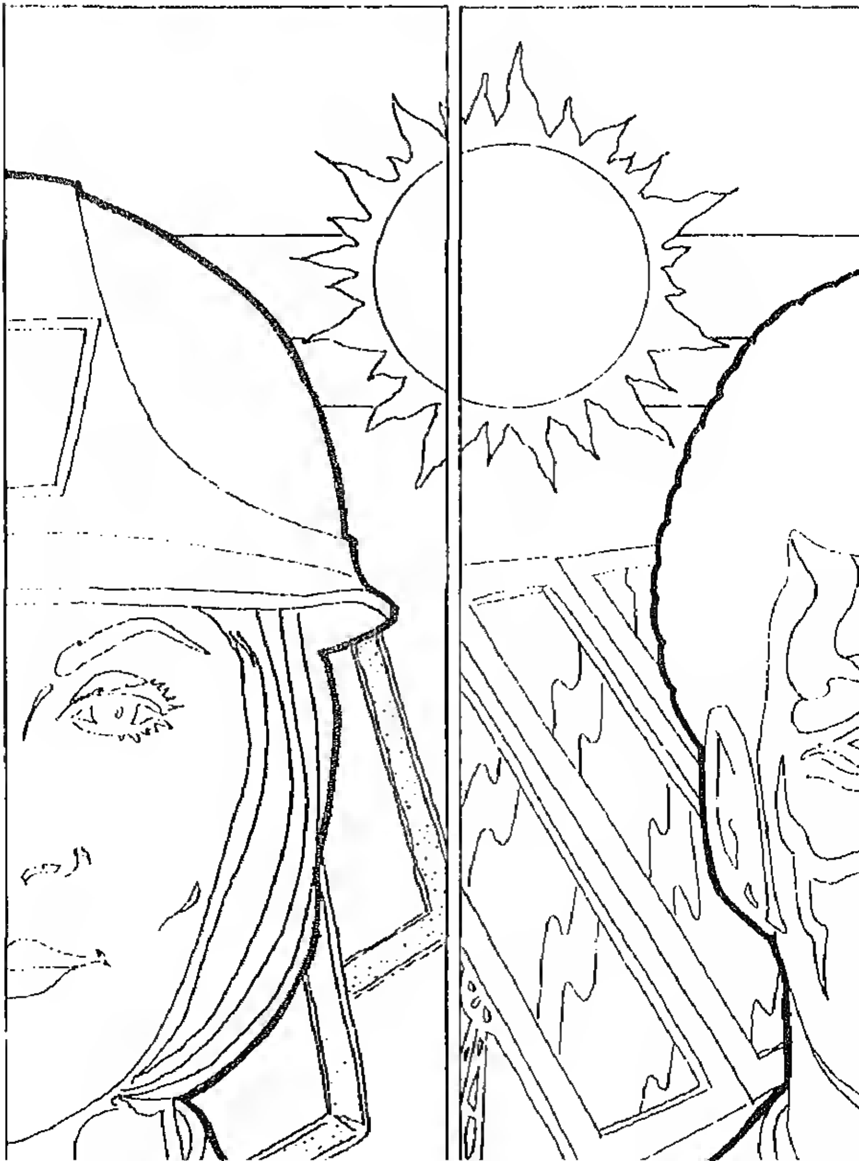
Creating Jobs Through Energy Policy



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o policy decisionmakers both in defining the scope of their evaluat as in determining the availability and cost of information necessar ask.

I fully recognize that the material in this handbook is terse, and antial effort on the reader's part to work through. The nature of evaluation is such that there is no simple, step-by-step presentat e used in all situations. However, this handbook will be periodica ed--both to take account of new data bases or methodologies, as wel ve the overall presentation of material. For this purpose, readers nts on the usefulness of this handbook for their particular policy ost welcome. Furthermore, policy analysts or decisionmakers who w his handbook in developing employment impact studies may feel free ct me for assistance.

Many individuals provided valuable input in completing this project of the major reviewers are listed in the handbook as "personal cont s that deserve special mention are Michael Kieschnick and Gregg Fe project evolved from an idea originally suggested to me by Michael helped me develop the methodology for determining informational r in Section I.

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Division of Advanced Energy
Systems Policy
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July 1979

DUCTION

This handbook is designed to help national, state, and local decisio
the following types of energy choices:

o Whether to mandate energy conservation measures or to build an
pipeline for importing energy into the region.

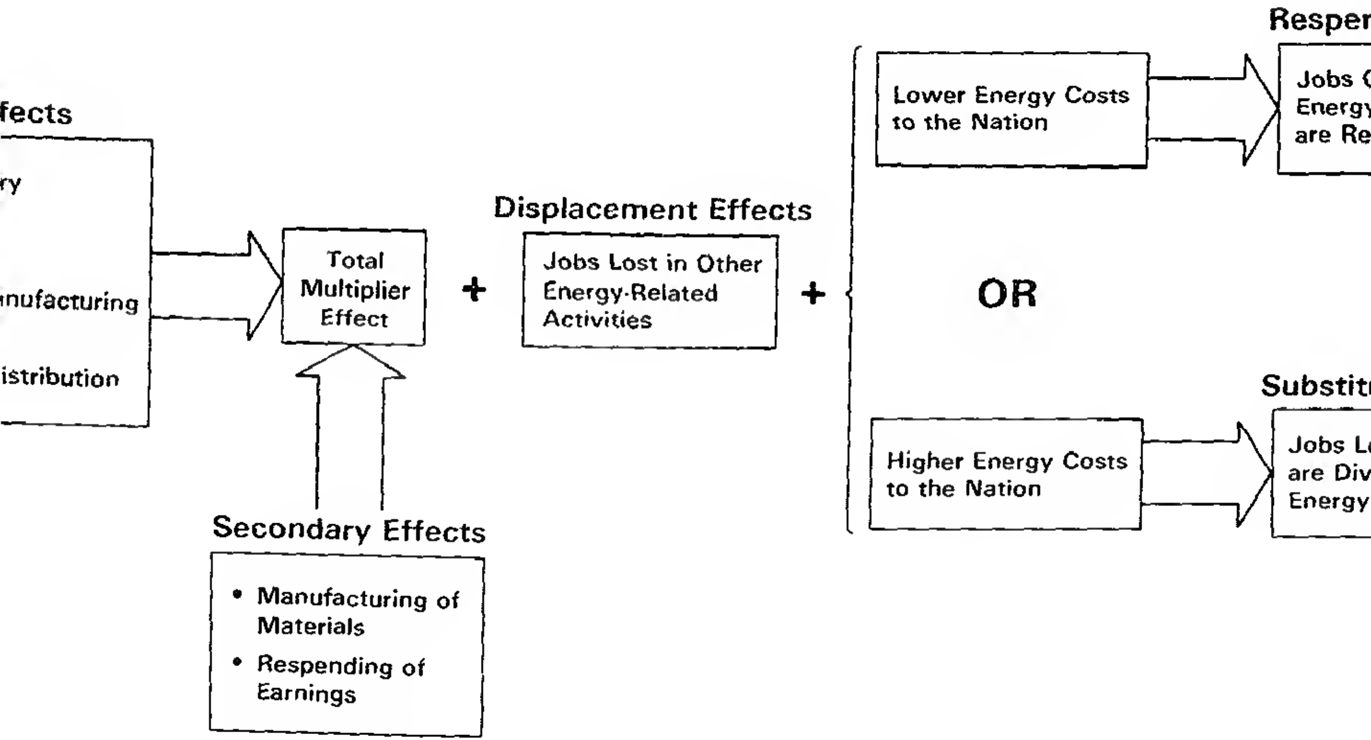
o Whether to subsidize investment in the solar energy industry, o
continue to rely on conventional energy sources.

o Whether to build a wood-fired powerplant or a nuclear plant to
electricity needs of the region.

In many of these cases, employment effects will be a factor weighe
naking the choice among energy alternatives. This handbook will hel
isionmakers with that part of the energy choice. Its focus is on th
loyment effects of energy development because job creation is one of
ic issues for the national or local economy. Other important issues
the quality of growth, stability of income and the provision of publ
vices ultimately depend on the number and quality of jobs. Local go
t services depend on tax flows, which stem from income which is earn
om employment. The importance of creating and maintaining jobs dicta
at policymakers take seriously the employment effects of public deci
rticularly those as fundamental as energy policy. At the same time,
oices can serve as a policy instrument for communities that desire m
ntrol over job creation in their area. It is therefore no wonder th
the debate over energy policy has focused on the job creation poten
ergy alternatives.

Energy development in general can have several effects on employm
e overall (or "net") effect on employment will depend on the relati
ude of the following factors (see figure 1):

(1) The <u>direct effect</u>, or the effect on labor requirements for
recovery, direct manufacturing, construction and general op
maintenance (O&M) associated with the energy development.
example, solar energy development creates direct jobs in co
component manufacturing, installation, operation and mainte
the construction and operation of backup power. For a powe
direct employment includes the labor required for plant co
resource recovery and transportation, turbine or generator
... and distribution.



fects
ry
nufacturing
istribution
Total Multiplier Effect
Secondary Effects
• Manufacturing of Materials
• Respending of Earnings
+
Displacement Effects
Jobs Lost in Other Energy-Related Activities
+
Lower Energy Costs to the Nation
OR
Higher Energy Costs to the Nation
Resper
Jobs C
Energy
are Re
Substit
Jobs L
are Div
Energy

to meet the demand for goods and services generated by the in earninga associated with (1) and (2).

The combination of these three effects is usually referred to as t al multiplier effect, which estimates the effects of a change in spe one part of the economy on total economic activity (including employ the region.* Moat multiplier analyses (and data sources) only disti ween the direct effects and "secondary effects"--that is, they combi rect and induced effects into a single component of the total multi e, for the purpoae of this handbook, these secondary impacts will b rred to jointly as "indirect/induced effects."

In addition to a positive multiplier impact, the energy choice car a negative displacement effect on employment if it reduces the lab irementa associated with an alternative energy source. For example cy deciaion may be to promote nuclear energy as a replacement for o lies. In thia case, the employment and earnings associated with fa through (3) would be reduced by the employment and earnings associa oil extraction, conversion and distribution.

Furthermore, energy choices will have a respending/substitution ef the energy source encouraged through policy measures incurs differ l costa than the next best alternative. If the energy source to be ess expensive than its alternative,** real economic growth (and hen oyment and income growth) occurs as these resource savings are resp dditional gooda and services. Conversely, an energy source that co per energy output than ita alternative, and is made available to t

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aection II, part 2 of thia report for a discussion of multipliers.

r the Nation as a whole, "costs" refer to the marginal, unsubsidize per unit of energy. For most solar systems and conservation metho price is equivalent to coat as defined above. For most conventiona gy technologies, however, prices are significantly lower than costs overnment subsidies and pricing policies. As long as these subsidi ided at the Federal level, however, it is unrealiatic for local com actor them into their energy costs. This is because the cost of Fe idies is spread over the entire Nation. Hence, a particular commun be only negligibly affected (See section II, part 4).

public, can decrease overall employment and earnings by divert
other (more labor-intensive) sectors of the economy.

Finally, the net employment effect of a policy choice wil
on the way the energy investment is financed. Finance refers
of funds used to pay for an energy system, including public gra
tax credits, private expenditures combined with public funds, c
funds alone (as in the case where a technology is mandated by l
energy investment is financed through increased private spendin
be diverted from other types of expenditures in or outside of t
This will offset some of the positive factors described above.

It is more likely, however, that public funds will be used
investment, either in the form of direct procurement or financia
to the private sector.* They will also divert spending from oth
of the economy, to the extent that public funds displace private
magnitude of this displacement depends on the method used to fin
expenditures and prevailing businesscycle conditions. There wil
one-for-one displacement of public for private funds if the publ
tures are financed through taxation. If, on the other hand, pub
tures are financed through debt, displacement will be greater wh
markets are "tight" (e.g., during a recession) than when the eco
financial markets are experiencing expansion.

Unfortunately, the analytical work in the area of energy and
limited.** Most of it to date examines only the <u>direct</u> employmen
associated with new energy technologies, in particular solar ener
vation, as compared to conventional alternatives. These studies
<u>for the same amount of useable energy</u>:

- Solar hot water, heating and cooling technologies, in re
  applications, can create two to eight times more <u>direct</u>
  conventional alternatives. In the case of liquified natu
  where most of the direct labor is created in foreign coun
  solar technologies can create 50 times as many <u>direct job</u>

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*It is possible that the energy investment will be financed by red
public expenditures in other programs. In this case, the decision
also need to consider the employment effects of reducing these exp
However, budget reorientation is rarely used as a means to finance
investments.

**See: The Job Creation P

o Conservation measures (i.e., insulation, weatherstripping, stor windows, etc.) create 26 times as many direct jobs as LNG, but fewer direct jobs than nuclear and other conventional powerplan

However, as mentioned earlier, direct jobs represent only part of t employment picture. In fact, the results of some recent studies i direct employment effects can be a misleading indicator of both the and direction of total job creation. For example, the recent Feder tic Policy Review (DPR) of solar energy compares the direct and ind yment effects of two accelerated national solar energy scenarios wi employment over the 1978-2000 period.** The study examines the lab rements of 13 different solar technologies, taking account of the j aced in the conventional energy sector due to increased solar penet results indicate that total employment over the period for the accel scenarios is 3 to 10 million person-years higher than for the base ugh these results indicate that accelerated solar energy strategies a positive effect on overall employment, the magnitude of this effe derably smaller
those implied by analyses that examine direct effects of residen- applications only. Furthermore, the DPR did not consider the relat of energy under each scenario, nor did it take account of labor-sa ction techniques that would probably be necessary to meet the level erated demand for solar.

For cost-effective energy conservation alternatives, recent studies ate that the total employment effects can be significantly positive sponsored by the Department of Energy (DOE) assesses the national effects of achieving Federal energy conservation goals pertaining t

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s is because most passive solar features are simple "add-ons" to entional buildings, and do not require a significant increase in con labor.

e Domestic Policy Review is an interagency task force mandated by Pr er to examine the barriers to widespread solar use, and to develop p ons for accelerating solar implementation. See: Domestic Policy Rev Energy: Final Report, Impacts Panel (Volume I) U.S. Department of ober 1978) TID-28835/1.

generated as net energy cost-savings are respent in the economy.

The results of this study indicate that, in meeting the mpg s
net employment in 1985 will increase slightly, but significantly (
to 20 thousand person-years). For the retrofit program, net emplo
1985 will increase by up to 520 thousand person-years. Another re
sponsored by DOE yields similar results for industrial cogeneratio
ties.** These results illustrate that direct employment alone pai
incomplete picture of the total job creation potential of conserva
particularly those that are cost-effective. What most people forg
these energy cost-savings will be respent in the economy and create
In fact, a recent study for the Joint Economic Committee indicates
respending effect can be at least as large as the direct and secon
ment effects combined.***

The extent to which direct employment is a misleading indicat
employment depends primarily on the size and diversity of the econ
question. In the case of a small isolated township that imports m
goods and services, direct employment effects would represent almo
the total employment effects experienced by the region. On the ot
direct effects will grossly misstate the total employment impact f
Nation as a whole, as the studies mentioned above indicate. Most
makers are faced with energy choices for regions that fit somewher
between these two extremes. This makes the task of determining th
information needed to determine employment effects much more diffi
Furthermore, gathering information on the employment effects of en
choices can be costly in terms of time and resources. For many en
technologies, such as solar and conservation, detailed, industry-b
information on the total employment effects is simply not availabl
other, more conventional systems, this information may be availabl
costly to procure and utilize for the decision in question.

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*Employment Impacts of Achieving Federal Energy Conservation Goals
P-1347, Institute for Defense Analysis, Arlington, Virginia. May

**An Analysis of the Macroeconomic Effects of Industrial Cogenerat
Development. JRB Associates, Inc., McLean, Virginia (September 19

***Employment Impact of the Solar Transition. Prepared for the Jo
Committee, U.S. Congress, by Len Rodberg (April 6, 1979, U.S. Gove
Printing Office).

The purpose of this handbook is to help policy decisionmakers ev
nergy alternatives in terms of their employment potential. The deci
ay be a Government official on the national, state or local level; s
ay be a member of a community planning council, a community developm
orporation, or member of a non-profit research group. This handbook
esigned to provide members of these groups with:

- o A working understanding of basic economic concepts and analy methods that can be used to estimate the employment effects choices;
- o A general framework for determining how much information on effects is relevant for the particular policy issue and the economy in question; and
- o Detailed references for where the information is available a costs.

Serious study of this compendium may eliminate some of the need
onsultants. Much of the information provided here can be utilized w
nploying professional economists. Some information, however, requir
se of more sophisticated modeling techniques that should be contract
o professionals. At the very least, this handbook will help the dec
aker evaluate the analytical work of consultants in the area of ener
nployment.

The handbook is organized into two sections, with attached appen
ection I presents a general conceptual framework for evaluating the
ent effects of energy choices. It describes the various types of em
ffects associated with energy development, and what factors affect t
ude of these effects. It also provides a methodology for determinin
mount and type of information needed to assess the total employment
particular region.

Section II first provides a general description of how to use th
andbook. It then presents a detailed listing of sources of informat
irect employment effects (part 1), indirect/induced effects (part 2)
ent effects (part 3), respending/substitution effects (part 4) and f
ffects (part 5). The availability and cost of this information is a
ncluded. Each section is designed to provide the user with a workin
tanding of how these informational sources can be applied. Detailed
or further reading are also presented.

t may be an implicit choice, such as a decision to continue supportive e.g., tax incentives) to conventional energy sources. In either case, ecisions will effect expenditure patterns in such a way that the deman articular energy source increases. This, in turn, will alter the leve mployment and earnings in the economy.

In order to accurately assess the overall effect of an energy choi mployment and earnings, decisionmakers will need information on the ma f the direct, secondary, displacement, respending/substitution, and fi ffects discussed in the introduction to this handbook. But the amount nformation needed will vary, depending on two major factors:

(1) The policy question to be addressed; and
(2) The degree of economic diversification in the region.*

The Policy Question. The amount of information needed will vary, n whether the policy question is:

(1) What is the total net employment/earnings impact of a policy to encourage energy technology A? The answer to this questio in the form of absolute amounts, i.e., the policy will yield of income and Y jobs in the economy. For example, a policyma state energy office might need to determine the employment ef introducing a sizeable tax credit for solar energy developmen

(2) In terms of net economic impact, how does a policy decision t encourage technology A compare to one to encourage technology The answer to this question will be in the form of comparativ amounts, i.e., the policy to encourage technology A will crea (or less) jobs than a policy to encourage technology B. For a Community Development Corporation (CDC) might face a choice investing in solar energy companies or firms that provide ene

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*For purposes of this report, the geographic area included within a reg roadly defined as an economic unit--an area with economic relationship nterdependencies among industries. A region may refer to a small rura ity and its service area, a large densely populated metropolitan area, ne far extreme, a massive region encompassing several states.

e effects described above. However, significantly less informati
eeded for the second question. In particular, it is usually unnec
fy the displacement effect when comparing energy alternatives that
per energy output. This is because, in most cases, the energy alt
be displacing the same energy source (in which case the decreases
uirements and earnings "cancel each other out"). Furthermore, in
energy alternatives that cost the same per energy output it is
ry to quantify the "financing effect," as long as the financing me
r for both investments.

lly, in comparing energy alternatives with unequal costs, it will
ary to quantify the respending/substitution effect in the case whe
native with the greater employment effect is also the most costly.
ation it becomes unclear which alternative yields the greatest net
unless the respending/ substitution effect is also measured.

example, suppose energy technology A creates 100 jobs per unit of
hile technology B creates only 50 jobs per unit. On the basis of
n alone, a decisionmaker would conclude that energy technology A s
ed--because it creates twice as many jobs in the economy than tech
r unit of energy.

ver, let us also assume that technology A costs $100 per unit of e
while technology B provides energy at $50 per unit. Furthermore,
at a dollar of personal disposable income spent in the economy cre
Promoting energy technology A would cost consumers $50 more per
than technology B--which represents 75 jobs that would otherwise
. Taking this "substitution effect" into account makes technology
attractive. In fact, technology B creates twice as many jobs per
as technology A when the substitution effects are included.

Degree of Economic Diversification. The amount of information nee
g energy policy choices also depends on the degree of economic

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y, the decisionmaker will need information on all of the effects w
adeoffs across different policy areas, where the investments are n
es for each other (except in a budgetary sense).

rs outside the region. Similarly, the local economy buys (or imports) er portion of its goods and services from outside the region. <u>The gre proportion of exports and imports, the more undiversified (open) the e</u>

Relatively limited information is needed for an economy where most of rials for energy systems are imported, and most of the personal income tal is spent outside of the area. For this "highly undiversified" are of the indirect, induced and respending (or substitution) effects wou orted." Furthermore, financing for the energy investment in a small, versified economy, will generally originate from outside the region (w exception of direct local taxation). Hence, a decisionmaker attemptin are two energy systems in terms of job creation in that area would, wi degree of confidence, base the comparison on direct effects only.

In contrast, for a well-diversified economy, direct employment effect e are a misleading indicator of the total net employment impact. An ysis based on direct economic effects discussed above would fail to ca significant secondary effects discussed above, and could lead to very eading policy conclusions.

Tables 1 and 2 present a summary of the amount of information needed ng energy policy choices, depending on the policy question asked and t ee of economic diversification in the region. As the tables indicate, racy of direct employment effects as an indicator for total net employ cts within the region will be greatest when:

(1) The economy in question is small and highly undiversified.

(2) The energy choices have equal costs per energy output.

(3) The policy question requires a comparative analysis of net emplo impacts among energy alternatives.

rnatively, the accuracy of direct effects as an indicator of total eff be lowest when:

(1) The economy in question is large and highly diversified.

(2) The energy choices have unequal costs per energy output.

of a "small, highly undiversified" and a "large, highly diversifie
Unless the region in question is a very isolated township or, in
extreme, the Nation as a whole, the decisionmaker is still left wi
of determining how much information is needed for an accurate
nt of employment effects. This requires a more detailed look at th
ship between economic diversification and the components of the tot
er effect. Specifically, it is necessary to determine, for economi
ying degrees of diversification, the proportion of the total multip
hat is captured by the direct effect only.* If this proportion is
ntly large (i.e., within the desired range of accuracy), the decisi
n save considerable amounts of time and financial resources by focu
ysis on direct effects only. If the proportion of direct component
ltiplier is lower than the desired degree of accuracy, the decision
d to devote the resources to estimate the indirect/induced effects
the direct.

order to provide this information, individual regions must be "rank
e of economic diversification and grouped into generic economies.
eneric economies enables the decisionmaker to draw conclusions abou
own region, without the need for collecting and analyzing data spec
egion. This can save considerable amounts of time and resources.
awback, however, is that predictions based on "reference" or "gener
more uncertain than those based on region-specific data.

means of achieving a ranking of economic diversification is to sim
e number of distinct industrial sectors in each region assigned to
group. It follows that the larger the number of distinct industria
the more diversified is the region. However, this procedure is
y time consuming. Furthermore, disclosure problems at all levels o
al detail would tend to make this an inconsistent exercise at best.

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ning the informational needs for the other factors (i.e., displacem
g and respending/substitution effects) is relatively straightforwar
al, the displacement effect requires estimation only for impact ana
ows the same procedure as the multiplier effects, except that an al
rgy source is examined. In most cases the financing effect will re
on, which can be done at fairly low cost (see section II, part 4).
rule of thumb, the respending effect should be estimated whenever t
hoices have unequal costs. The exception to this rule is when a
ive analysis is required <u>and</u> only direct effects need estimation
desired degree of accuracy.

TABLE 1

Question (1) Comparison of Net Employment Impacts among Energy Alternatives

A. Equal Costs per Energy Output

Type of Economy	Direct	Indirect/Induced	Displacement	Respending Substituti
Large (diversified)	X	X		
Small (undiversified)	X			

B. Unequal Costs per Energy Output

Type of Economy	Direct	Indirect/Induced	Displacement	Respending Substituti
Large (diversified)	X	X		X
Small (undiversified)	X			

*Only if methods are different for each investment.

**Only if direct taxation is used for one investment and not for the other.

TABLE 2

Question (2) Total Net Employment
Impact of Energy Investment

A. Equal Costs per Energy Output

Type of Economy	Types of Information			
	Direct	Indirect/Induced	Displacement	Respending/ Substitution
Large (diversified)	X	X	X	
Small (undiversified)	X		**	

B. Unequal Costs per Energy Output

Type of Economy	Direct	Indirect/Induced	Displacement	Respending/ Substitution
Large (diversified)	X	X	X	X
Small (undiversified)	X		**	X

*Only if direct taxation is used for the investment.

**Only if direct employment for displaced system is provided locally.

similar. This can be accomplished by first assigning economies to non-SMSA groups to distinguish between urban and rural economies.** SMSA group can be subdivided into large and small SMSA's, based on population levels. All groups are then further subdivided into geo regions, which characterize their economic structure. They are fur described by their rates of growth, as suggested by Van Zele. The represented in figure 2.

Seventeen generic economies emerge from this classification sc representing a group of specific regions with similar levels of eco diverisfication (see table 3). Furthermore, each of the 173 Bureau Analysis regions (see figure 3), SMSA's, and non-SMSA regions in th States can be classified under one of these generic economies. A l regions by corresponding generic economy is presented in tables E-l Appendix E.

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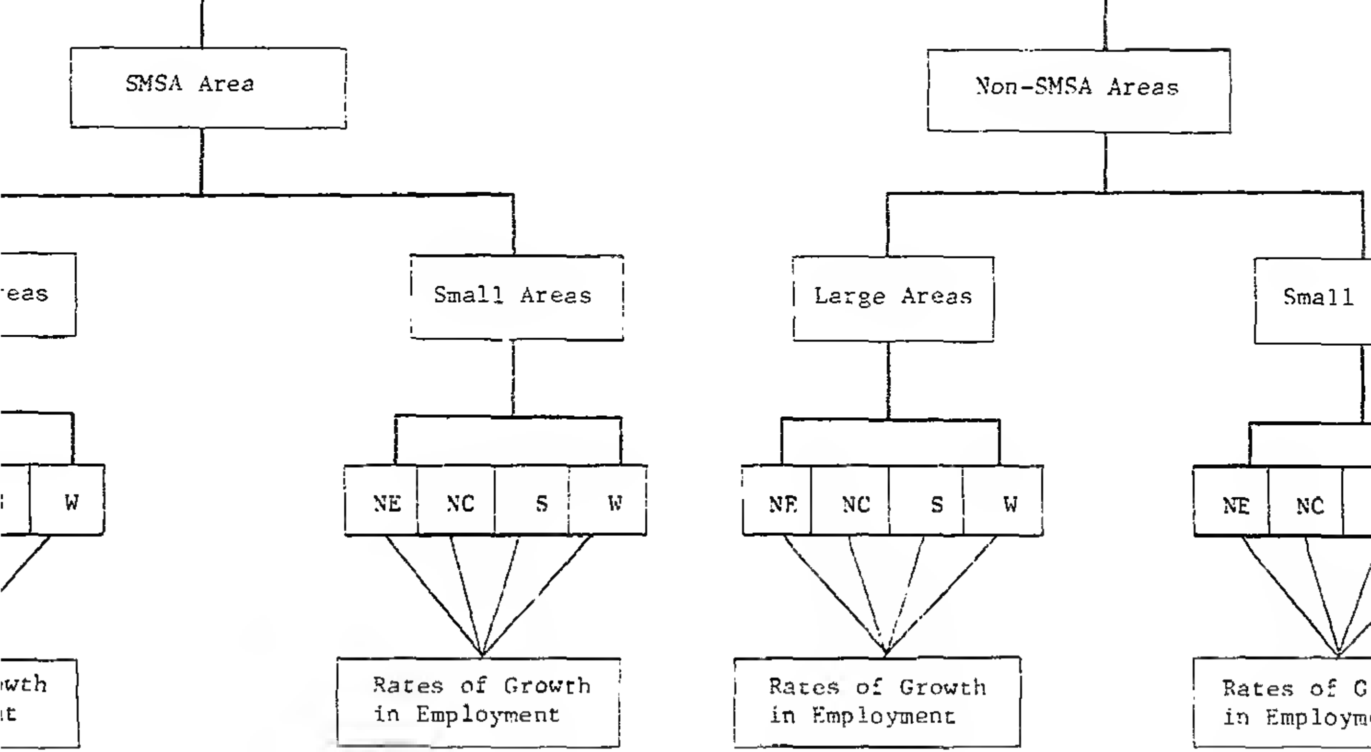
*See: "On Measuring Economic Diversification," by Merlin M. Hackba Donald A. Anderson, in: Land Economics, LI 4, November 1975, pp. Concept and Measurement of Regional Industrial Diversification," by Conroy, in: Southern Economic Journal, Volume 41, No. 3, January 1 492-505; "A Portfolio Theoretical Approach to Industrial Diversific Regional Employment," by James Barth, John Kraft and Phillip Wiest. of Regional Science, Vol. 15, No. 1, 1975, pp. 9-15.

**Regional Analysis of Energy Development Impacts and Responses: S Methods, Results and Needs by Roger Van Zele (University of Pennsyl 1977).

***A Standard Metopolitan Statistical Area (SMSA) is defined as a c group of counties which contains at least one city of 50,000 inhabi more, or "twin cities" with a combined population of 50,000. Conti ties are included in an SMSA if they are socially and economically with the central city. See: Statistical Abstract of the United St U.S. Department of Commerce, Bureau of the Census, Appendix II.



2: Diagrammatic Representation of Classification Scheme for All U.S. Regional Economies

Northeast

North Central

South

Regional Data	Growth Rate		Centralized Conventional Energy Systems		WECS	
	%	Rank	%	Rank	%	Rank
SMSA, Large						
1. North	1.07	17	55.0	17	55.9	15
2. South	2.11	8	60.5	15	57.9	14
3. West	3.15	5	55.1	16	55.2	16
SMSA, Small						
4. Northeast	1.17	16	63.5	14	64.5	13
5. Southeast	2.35	7	67.1	9	65.6	10
6. East North Central	3.39	4	67.7	8	65.9	8
7. West North Central	1.51	14	64.3	13	65.1	11
8. East South Central	3.09	6	64.4	12	64.9	12
9. Mountain	4.39	1	68.6	7	65.7	9
10. Pacific	4.00	2	72.2	4	69.7	6

*Including photovoltaics

Data	Growth Rate		Centralized Conventional Energy Systems		WECS		Solar Collect Technol
	%	Rank	%	Rank	%	Rank	%
A, Large							
.	1.98	9	65.4	11	65.6	10	65.5
A, Small							
rtheast	1.22	15	66.0	10	67.1	7	66.0
utheast	1.96	10	71.4	5	70.0	5	71.8
st North ntral	1.62	13	70.0	6	70.9	3	70.0
st North ntral	1.93	11	77.0	1	74.9	1	77.4
st South ntral	1.91	12	74.0	2	71.6	2	74.4
st	3.83	3	73.2	3	71.0	4	73.6
S.A.	2.39						

ing photovoltaics.

energy conversion systems and centralized conventional energy syste
representative facilities are described in greater detail in Append
each generic economy, the proportion of direct component-to-total e
effect associated with each of these representative energy systems
estimated. The results are presented in table 3.

As indicated in the table, the amount of information needed to assess the employment effects of an energy choice varies significan economies. For example, the direct emplnyment effects of an invest centralized conventional systems for regions classified under Gener represent only 55 percent of the total employment effects. For Gen 15, on the other hand, direct effects account for about 80 percent for a similar investment. Hence, a decisionmaker facing an energy region similar to Generic Economy I would need to estimate direct a induced employment effects, whereas for a region similar to Generic 15, an estimate of direct employment effect would probably be suffi

Note that the ratio of direct component-to-total multiplier do consistantly decrease as diversificatinn increases. This is becaus direct-to-total ratio depends on more than just an indicater of eco sification: It depends on the specifics of the economy's structure requirements of the investment project. For example, consider an e undertaken in an economy whose industrial structure is such that a amount of direct inputs can be supplied locally, but all indirect i locally supplied. The implication is that the economy is reasonabl and the total local multiplier may be significant. However, the ra component-to-total multiplier would be miniscule. Conversely, cons situation in which few indirect requirements can be locally supplie direct requirements can be locally supplied. Again, the total mult significant and the economy is fairly diverse. This time, however, component-to-total multiplier ratin would be large. Reality, of co

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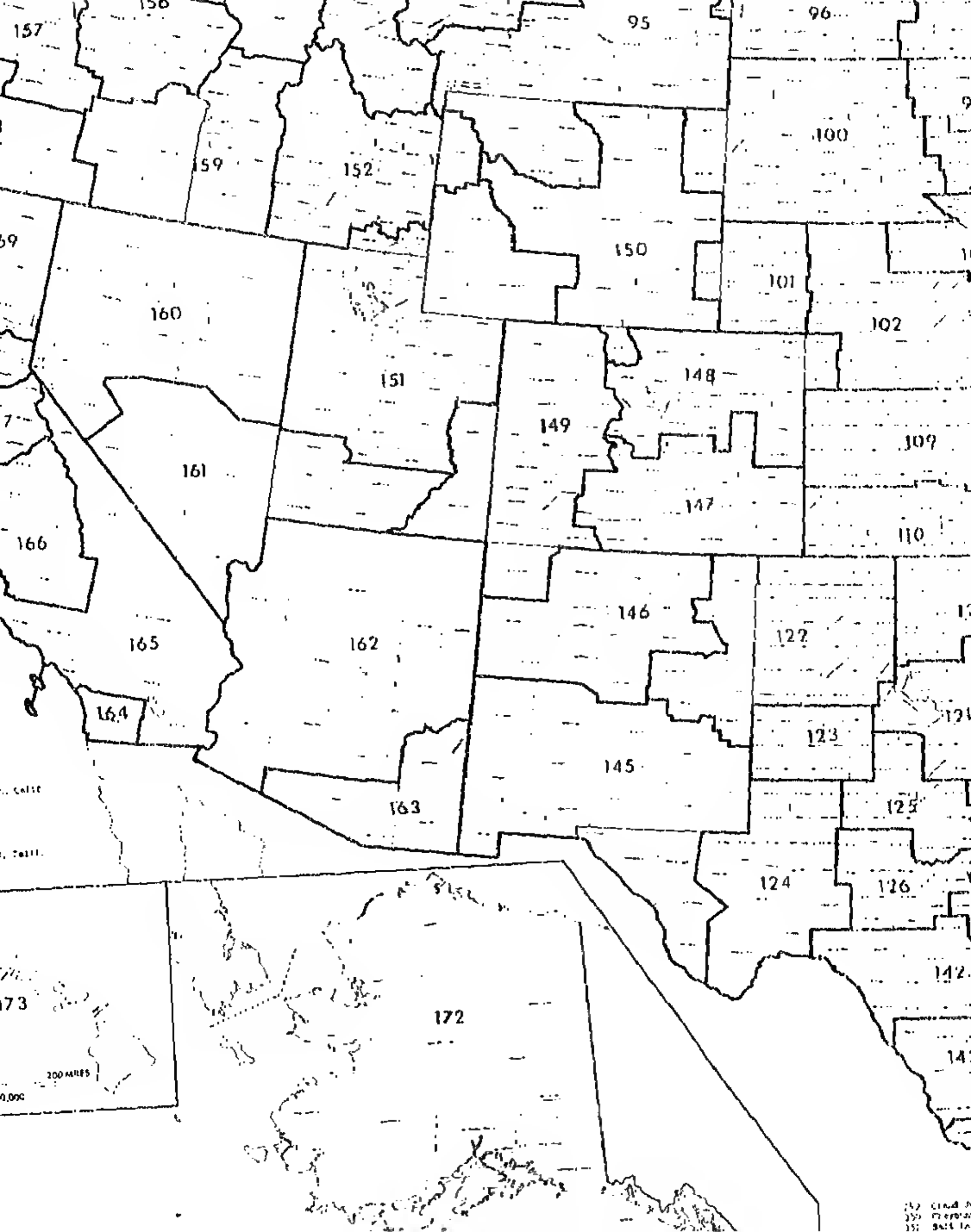
*See: <u>A Method for Assessing the Size of Regional Multipliers and Components</u>, by Gregg Ferris, Solar Energy Research Institute, Golde (DRAFT, March 1979). The Institute will be publishing a detailed m for developing generic economies and representative energy systems by fall 1979. A summary of the methodology used is presented in Ap

s described above, table 3 is designed to aid decisionmakers in
ining their informational needs for assessing the employment effec
choices. However, important qualifications must be attached to t
s data. Several notions of "generic" or "reference" cases have be
Whenever reference data are used, potential users of those data m
d that the data probably do not describe nonreference experiences
imitation also applies to any use of this table for regions larger
r than those specified in table 3. Users of this information are
autioned to consider the realities of the situation and apply the
eport judiciously. Despite these limitations, the data in table 3
rovide a reasonably accurate guide to informational needs. For th
s mentioned above, the table is not designed to be used in estimat
te level of the employment multiplier or its components. These es
should be based on data sources that are as specific as possible t
economy. The purpose of section II is to provide the user with re
formation of this type.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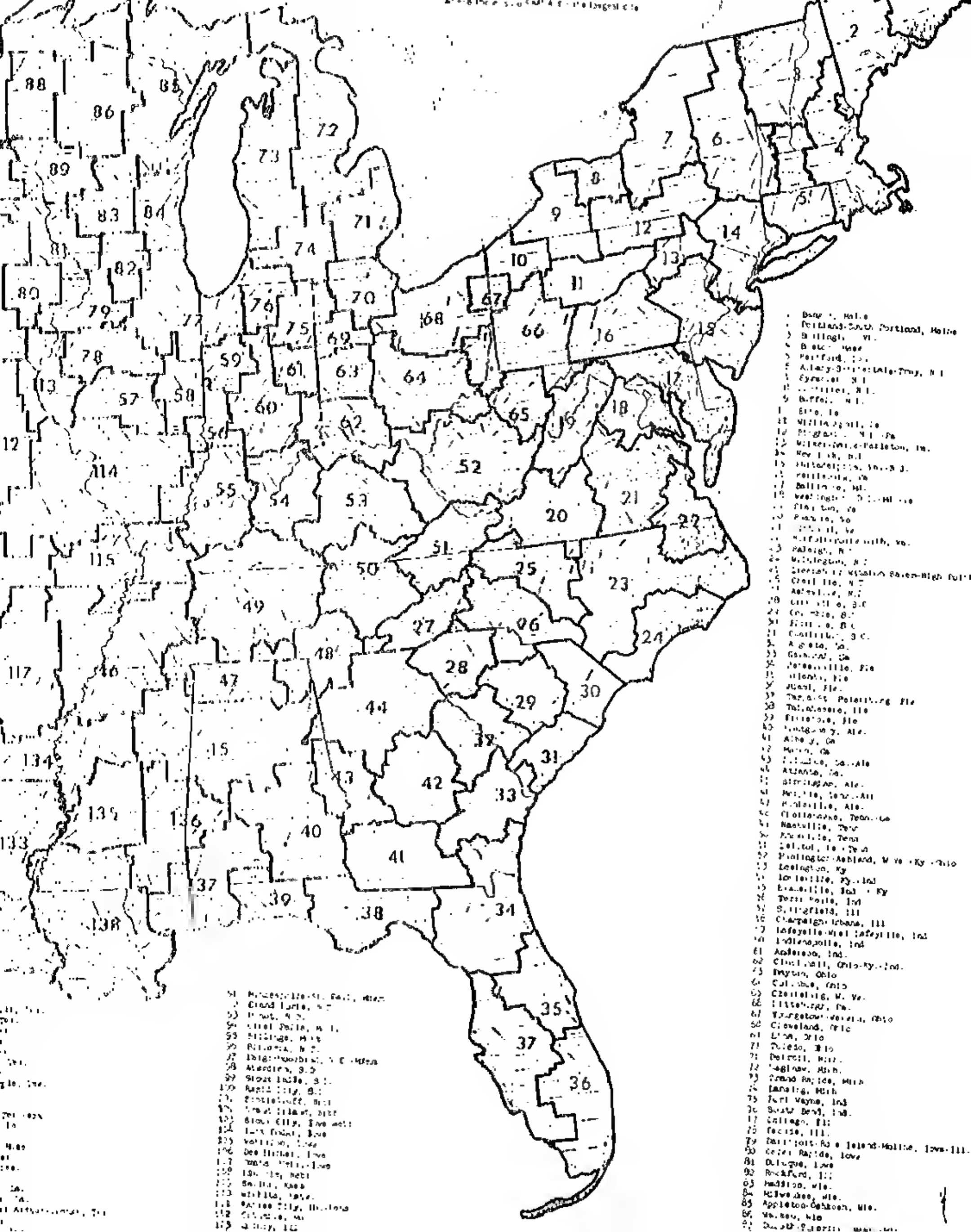
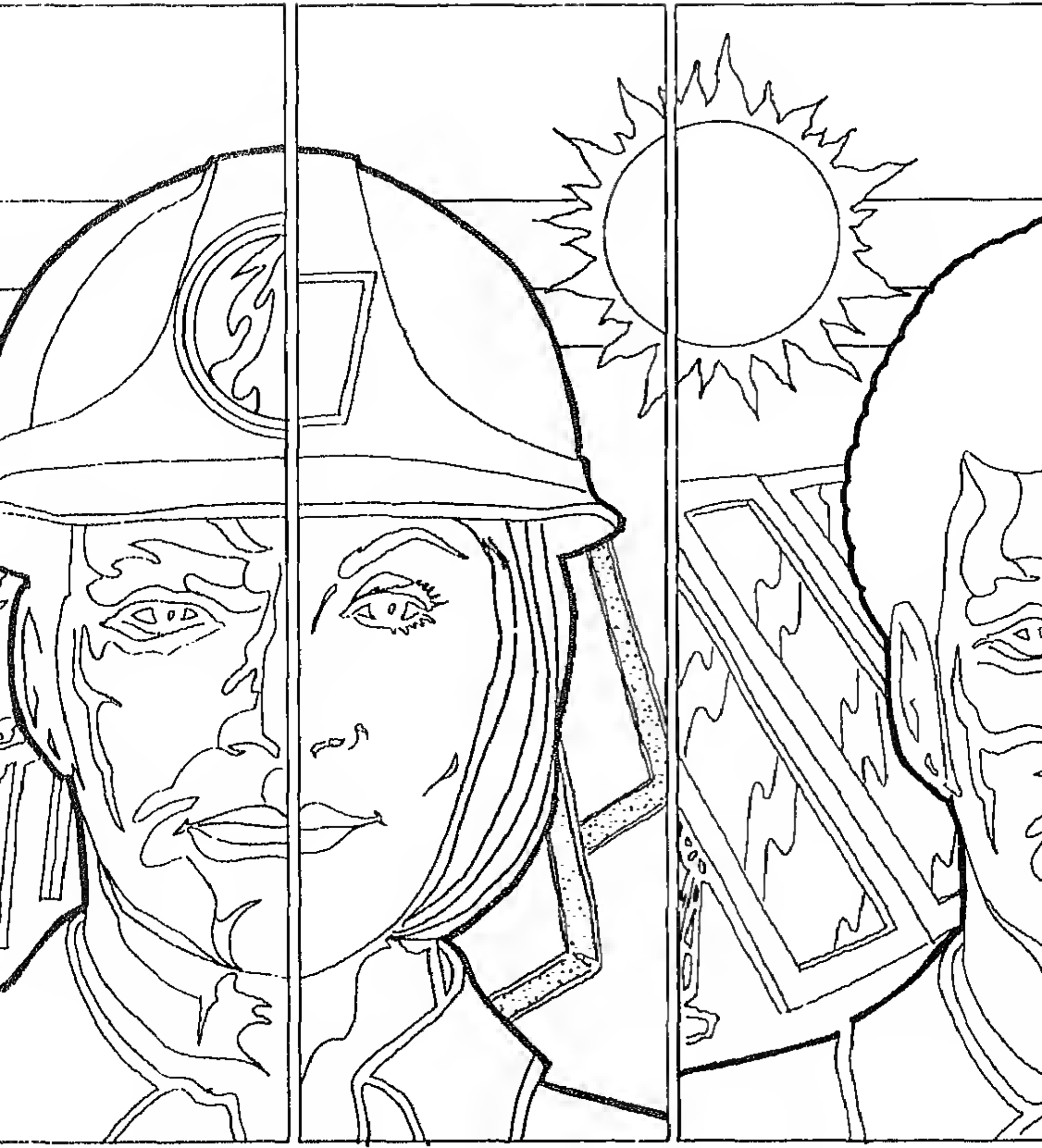


2 Portland-South Portland, Maine
13 Wilkes-Barre-Hazleton, Pa.
17 Baltimore, Md.
23 Raleigh, N.C.
24 Wilmington, N.C.
34 Jacksonville, Fla
37 Tampa-St. Petersburg, Fla
38 Tallahassee, Fla
41 Albany, Ga
44 Atlanta, Ga.
45 Birmingham, Ala.
48 Chattanooga, Tenn.-Ga
49 Nashville, Tenn
50 Knoxville, Tenn
52 Huntington-Ashland, W.Va.-Ky.-Ohio
53 Lexington, Ky
54 Louisville, Ky.-Ind
55 Evansville, Ind.-Ky
56 Terre Haute, Ind
57 Springfield, Ill
58 Champaign-Urbana, Ill
59 Lafayette-West Lafayette, Ind
60 Indianapolis, Ind
61 Anderson, Ind.
62 Cincinnati, Ohio-Ky.-Ind.
63 Dayton, Ohio
64 Columbus, Ohio
65 Clarksburg, W. Va.
66 Pittsburgh, Pa.
67 Youngstown-Warren, Ohio
68 Cleveland, Ohio
69 Lima, Ohio
70 Toledo, Ohio
71 Detroit, Mich.
72 Saginaw, Mich.
73 Grand Rapids, Mich
74 Lansing, Mich
75 Fort Wayne, Ind
76 South Bend, Ind.
77 Chicago, Ill.
78 Peoria, Ill.
79 Davenport-Rock Island-Moline, Iowa-Ill.
80 Cedar Rapids, Iowa
81 Dubuque, Iowa
82 Rockford, Ill.
83 Madison, Wis.
84 Milwaukee, Wis.
85 Appleton-Oshkosh, Wis.
86 Wausau, Wis
92 Grand Forks, N.D.
98 Aberdeen, S.D.
99 Sioux Falls, S.D.
100 Rapid City, S.D.
103 Sioux City, Iowa-Nebr.
106 Des Moines, Iowa
111 Wichita, Kans.



attain the highest degree of confidence in an analysis of ener
reality, however, there are cost, time and availability constr
the ability of decisionmakers to obtain all the information ne
cated in table 3, the cost of making energy choices on the bas
information is reduced confidence in the outcome. However, th
minimized if scarce resources are devoted to obtaining informa
employment effects most relevant for the economy in question.
section I was to assist decisionmakers in assessing which type
are most relevant for energy policy choices.

In addition, the "uncertainty" associated with energy cho
reduced as more detailed information on the relevant employmen
available to decisionmakers. Unfortunately, there is almost a
ship between the level of detail and the level of costs, so th
constraints are a major limiting factor. Sources of informati
employment effects of energy choices range from individuals wh
data on the labor intensity of various energy technologies to
systems that are available at relatively high cost. The purpo
is to present a list of relevant references for this type of i
starting with the simplist, least-costly sources to the most c
expensive (see table 4). On the basis of section I, the decis
decide which types of information are the most relevant for hi
Then, using the references presented below, the decisionmaker
exactly where the information is available and at what cost.
are six major steps to follow in using this compendium:

- o <u>Step 1</u>: Determine the level of economic diversificati
  in question. This can be done using tables E-1 and E-
  and table 3 above, which allocate specific regions to

- o <u>Step 2</u>: Determine how much of the total employment ef
  by the direct component alone. This can be done using
  presents the direct component-to-total multiplier for
  Economy.

- o <u>Step 3</u>: Decide whether the degree of accuracy implied
  component-to-total is sufficient for the task. If it

employment effects are within the budget. This can also be done using table 4.

- o Step 6: Determine whether the displacement, financing and respen substitution effects require estimation. This can be done using 1 and 2. Informational sources on these types of effects are pre in section II, parts 3, 4 and 5.

A specific example will help to illustrate how this handbook can be ionmakers on the national, state or local level: Suppose that a Com opment Corporation (CDC) in the El Paso, Texas SMSA area wants to as ocal employment impact of investing in solar collector manufacturing nies. Assume that the financing for this investment will originate al grant, and that the budget for the employment impact study is $20

Following the steps outlined above, the CDC decisionmaker should fir to table E-1 in Appendix E and table 3. From table E-1, she/he lea the economy of El Paso SMSA is approximated by Generic Economy 16. ding to table 3, direct effects alone will account for about 75 perc otal employment effects. The decisionmaker decides that this level acy is sufficient for the task.

Informational sources for direct employment, and their costs, are pr rt 1 of this section. Table 4 lists these sources by increasing cos s the reader to the sections in part 1 that describe each source in 1. In this example, the decisionmaker could use the following sourc ate the number and types of jobs associated with solar energy develo

- o Individuals with access to labor-intensity coefficients;

- o Summaries of institutional studies, industry estimates and survey

- o Detailed Characteristics volumes from the 1970 Census;*

- o Data tapes for the Brookhaven National Laboratory Input-Ouput Model, and the Regional Industrial Multiplier System;

---

example, this particular source can be useful in determining the typ associated with manufacturing of solar components and collectors, as the labor requirements are similar to those in most types of manufac

o The Bureau of Economic Analysis Regional Economic Informat
(REIS);

o The Bureau of Census "County Business Patterns";

o The Bureau of Labor Statistics (BLS) data tapes.

The other sources listed in table 4 either cost more than the will permit, or else do not contain information applicable to dece solar technologies.

Since some of the data sources mentioned above contain nation only, the decisionmaker should also contact the local Employment S and Local Buildings and Trades Council to make sure that the skill required are available locally. In addition, the decisionmaker mi compare the employment effects of solar energy development to a "b tion, using REIS projections of employment and earnings for the ar

The next step is to determine how much information is needed the displacement, financing and respending/substitution effects. section I, indicates that information on the displacement effects only if the direct employment for any displaced energy is provided To get a better handle on the displacement effect, the decisionma look at any of the regional information sources (within the budget table 4. In particular, the Bureau of Census County Business Patt be useful in determining the size of local area employment in exis sectors. A call to the Local Buildings and Trade Council would al (and free of charge).

Table 2 also indicates that the financing effect does not req estimation for this example. This is because funds for the energy will originate outside the local area, i.e., from the Federal Gove However, the respending/substitution effect does require estimatio provides energy at a different cost per unit than existing energy 4 of this section can be used to evaluate the respending/ substitu

The example described above is specific to community-level en choices. Choices that are made for larger regions--or the nation a whole--would require different amounts of information. To use the component proportions in table 3 for regions that contain both SMS

$$j = \sum_{i=1}^{n} \frac{DCP_i \cdot E_i}{E_o}$$

re DCP_j = the direct component proportion of a region, j, composed of more than one generic economy

$_i$ = the direct component proportion of generic economy i (e.g., i = SMSA - Large)

= the level of employment in all the generic economies of type i in the aggregated region

= the number of the generic economies

= the level of employment in the aggregated region

er organizations may be able to afford larger budgets for employment analyses than the CDC in the example above. In this case, the nmaker will examine additional, "higher cost" informational sources ose used above. However, the general steps to follow in using this k will apply in all cases.

t 1. Direct Employment/Earnings Effects. The following sources vide information on the direct employment/earnings effects of energy s

Individuals with access to labor-intensity co-efficients. The most approach to determining direct labor requirements for energy systems se national estimates of person-hours/mmBtu/year or person-hours/$ ent for the particular energy technology. Several people in the Government and private sector have worked with studies that assess atios for conventional as well as solar/conservation systems. These

Meg Schachter
Department of Energy
Forrestal Building
Room 6E-068
1000 Independence Avenue SW.
Washington, D.C. 20585
202/252-6433

TABLE 4: SOURCES AND COSTS OF DIRECT AND INDIRECT/INDUCED EMPLOYMENT INFORMATION

o National Information
● Regional (Sub-national) Information

ment

Source of Information	Sponsoring Organization	Cost of Information
●o Individuals with Access to Information	--	free
●o Institutional Studies, Industry Estimates	--	free
● Local Building and Trade Councils	AFL-CIO	free
● Social and Economic Assessment Model (SEAM)	Argonne National Laboratory	free
o Brookhaven National Laboratory Laboratory Input - Output Model (BNL/I-O)	Brookhaven National Laboratory	free
● Regional Industrial Multiplier System (RIMS)	Bureau of Economic Analysis (Bea), U.S. Department of Commerce	free
● North Dakota Regional Environmental Assessment Program (REAP)	North Dakota REAP	free
o Solar Energy Research Institute (SERI) Data Base	SERI	NA
● Environmental Impact Statements	Atomic Industrial Forum, Inc.	$ .25 per page
o Energy Supply Planning Model Data Base	Bechtel National, Inc.	$ 5 - $ 75

o National Information
● Regional (Sub-national) Information

Source of Information	Sponsoring Organization	Cost of Information
o Bureau of Labor Statistics Input - Output Model (BLS/I-O)	Bureau of Labor Statistics (BLS), U.S. Department of Labor	$ 65 - $100a/
●o U.S. Department of Labor Construction Manpower Demand System	U.S. Department of Labor	76 - 300
●o BLS Data Bank Files	BLS, U.S. Department of Labor	0 - 285a/
● "County Business Patterns" and "Detailed Characteristics" Volumes from 1970 Census	Bureau of Census, U.S. Department of Commerce	10 - 320
● SEAM	Argonne National Laboratory	b/
● Arizona Economic Demographic Projection Model (EDPM)	Office of Planning, Arizona	50 - 75
o BLS/I-O	BLS, U.S. Department of Labor	100a/
● Utah Process Economic and Demographic Impact Model (UPED)	Office of State Planning Coordinator, Utah	150
o Brookhaven I-O/BESOM System	Brookhaven National Laboratory	100 - 300b/c/
● RIMS	BEA, U.S. Department of Commerce	Up to $1,000
● Bureau of Reclamation Economic Assessment Model (BREAM)	Bureau of Reclamation, Denver, Colorado	680 - 800b/

d

es only.
edure for the use of this model has not yet been established.
time only; data is free of charge.

TABLE 4 (continued): SOURCES AND COSTS OF DIRECT AND INDIRECT/INDUCED EMPLOYMENT INFORMATION

o National Information
● Regional (Sub-national) Information

ployment	Source of Information	Sponsoring Organization	Cost of Informatic
ct/Induced nued)	● State Survey - Based Input - Output Model	State Energy Offices, Universities, Utilities	$ 100 - $1,000[d]
	● Regional Science Research Institute Model (RSRI)	Regional Science Research Institute	500 - 1,350[d]
	o INFORUM Model	University of Maryland	5,000
	● Energy Systems Research Group Model (ESRG)	Energy Systems Research Group	6,000 +
	● REAP	North Dakota REAP	$30,500 for ada to other region
	●o Lawrence Berkeley Laboratory Model	Lawrence Berkeley Laboratory	Up to $100,000

1536 Cole Boulevard
Golden, Colorado 80401
303/231-1053

Erick Stenehjim
Argonne National Laboratories
9700 S. Cass Avenue
Argonne, Illinois 60439
312/972-2000 ext. 3754

Leonard Rodberg
515 N. 110 Street
Apt. 7G
New York, New York 10025
202/483-3321 or 212/662-2463

Robert A. Herendeen
Energy Research Group
333 Advanced Computation Bldg.
Urbana, Illinois 61801
217/333-7168

William F. Hahn, Coordinator
Construction Labor Demand System
U.S. Department of Labor, Room N-2423
200 Constitution Avenue, NW.
Washington, D.C. 20210

William R. Schriver
Project Manager
Forecasting and Analysis Office
Tennessee Valley Authority
327 Miller's Building
Knoxville, Tennessee 37902
615/632-3714

Paul Paskert (415/768-5775), or
Michael Gallagher (415/768-7949)
Bechtel National Inc.
P.O. Box 3965
San Francisco, California 94119

B. Summaries of institutional studies, industry estimates and su[rveys]
[Sev]eral recent studies have compiled data on the direct labor requireme[nts]

On the basis of institutional studies, industry estimates, environment statements and reports, the number of employees required for manufactu construction, operation and system design were determined. The result these studies are presented in tables A-1 through A-20 (appendix A). makers can select pertinent information from these tables and make add to this data when other, more specific information is available.

C. Local building and trade councils are sources for free inform on the availability of local labor for over 15 construction crafts. Mo councils can also provide information on the skills needed for a partic energy project, on the basis of past experience. There are 450-480 cou throughout the country. Phone numbers are available through the Buildi Construction Trades Department, AFL-CIO (815 16th Street, NW., Washingt D.C.; phone: 202/347-1461; Contact: Guy Roth).

D. Environmental Impact Statements (EIS) are a good, inexpensive or information on the employment effects of energy projects. The Atom ndustrial Forum, Inc. (INFORUM) maintains an extensive library and bib f EIS's (and Environmental Reports) for fossil fuel and nuclear powerp rojects and transmission lines. Most EIS's require information on the ent impacts of the energy project, although the quality of the analysis ary widely from statement to statement. The projects are classified by the facility, but are cross-referenced by geographic region and other tegories.

st and Availability of Information:

INFORUM will provide copies of the EIS (or Environmental Reports) o bsections of the reports (e.g., the employment impact section) for $0. ge. Contact:

Elizabeth Hannon
INFORUM
Atomic Industrial Forum, Inc.
1016 16th Street, NW.
Washington, D.C.
202/833-9234

E. The Bechtel data base for the Energy Supply Planning Model (ESPM) tains detailed national average cost and employment information on 101 cted energy facilities (see tables C-1 and C-2 in appendix C). Each lity is designed in terms of an average size ...
technology and ...

construction costs, which include primarily labor, mate
equipment costs; (2) land costs; (3) general plant (e.g
ties shared by a vertically integrated company like the
yard of an electric utility which services a powerplant
mission lines); (4) tangible assets (e.g., licenses, pa
(5) escalation during construction--this compensates fo
able cost increases occurring during the construction p
interest during construction; and (7) working capital (
special funds). These cost estimates are in January 19
dollars and are presented in total (as opposed to annua
amounts. They are based primarily upon in-house engine
estimates by various divisions of Bechtel Corporation.
more, this data base matches material and equipment cos
by appropriate BEA sectors (see section K(2b)). Althou
costs (i.e., capital cost per unit of energy output or
not explicitly present in the data base, this informati
derived from the background documentation on each facil

- Operating and Maintenance Costs -- O&M costs for each e
facility are presented in this data base. These costs
segmented into six major categories and 25 minor catego
The former are: (1) labor; (2) materials; (3) equipmen
utilities; (5) rent; materials and equipment costs corr
directly to comparable categories under capital costs.
tion, these costs are presented in January 1978 current
The cost estimates were initially determined by Stanfor
Institute, but updated periodically by Bechtel.

- Labor Requirements -- For each facility, labor requirem
are estimated for both the construction and O&M phases.
requirements, which are presented in thousand person-ho
listed under two general groups: non-manual and manual

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*This summary of the Bechtel data base was drawn from: A Review of
Bases For Energy/Employment Analysis in an Input-Output-Framework, (
Consad Research Corporation, prepared for Department of Energy (DOE)
1979). Contact: Norman Seltzer, DOE, Intergovernmental and Institu
Relations (202/252-5931). The ESPM model can also be used by the pu
although the costs may be prohibitive for local groups. For more in
contact: Dr. Phiroze Nagarvala, Bechtel National, Inc., P.O. Box 39
Francisco, Ca. 94119 (415/768-8555).

(e.g., mechanics, machinists, etc.).

- Length of Construction Period -- The length of the period for each facility is included in this data presented in both number of years and the proporti tion activity which will be completed during each

- Materials Requirements -- About 49 selected materi items, which are used in the construction of each contained in the data base. The quality of materi during the operating phase of each facility are no the data base.

Technical reports on the Bechtel data base are available t National Technical Information Service (NTIS) 5285 Port Royal R Virginia 22161, at their listed prices (typically between $5 t reports of primary interest in this area are:

Escalation in the Costs of Manpower, Materials and Equipme Energy Facilities. Bechtel Corporation, San Francisco. (O Report #PAE 3794-F.

Resource Requirements, Impacts and Potential Constraints A Various Energy Futures. Bechtel Corporation, San Francisc 1978) #PAE 3794-9.

The Bechtel data base is also available on computer tapes, obtained for about $75 and are currently being updated. Contac

Paul F. Paskert (415/768-5775)
or Michael Gallagher (415/768-7949)
Bechtel National, Inc.
Post Office Box 3965
San Francisco, California 94119

F. The Department of Labor has developed a low-cost, easi model to determine national or regional labor requirements by c related construction projects. The Construction Manpower Deman can forecast, for periods up to 10 years in the future, the con requirements for:*

---

*CMDS also forecasts construction labor requirements for reside non-residential buildings, and non-building (non-energy) struct type of information would be useful for evaluating the l...

- o Uranium Mining, Refining, Processing and Storage.
- o Petroleum Production, Refining, Processing and Transportation
- o Natural Gas Development, Processing, Production and Transport
- o Other Energy Projects and Facilities (including Hydroelectric

S provides information on monthly labor requirements over the construc iod for 29 construction crafts.

In addition, CMDS provides information on five on-site technical upations (e.g., engineering and management) two non-technical (e.g., rical) on-site occupations, and operation and maintenance (O&M) requir ts by occupation for all energy projects. The CMDS also generates the e bill over time by craft, as well as materials and equipment costs, saggregated to two-digit Standard Industrial Classification (SIC).*

The model also forecasts monthly labor demand (by craft) for all struction activity in the region. This information can be used by reg state planners to determine whether a new energy construction project se supply bottlenecks in certain craft categories. The Department of L) releases a report on total construction manpower demand for each st e or twice a year. Upon special request, the DOL can provide this inf n by Bureau of Economic Analysis (BEA) regions (see figure 3 in Sectio

The cost of a report on monthly manpower requirements (by craft) for gle facility in a region is $76. The cost of demand forecasts for tot struction manpower is:

by state	$0
by BEA region	$200-$300

further information, contact:

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blished employment statistics usually follow the classification scheme Standard Industrial Classification Manual, Executive Office of the sident, Bureau of the Budget (U.S. Government Printing Office, 1972). rief but excellent discussion of this classification scheme, see: Mak se Out of Dollars: Economic Analysis for Local Government (November l 14-16). Available from the National League of Cities, 1620 Eye Stree

327 Miller's Building
Knoxville, Tennessee 37902
(615) 632-3714

G. The Solar Energy Research Institute (SERI), data base, in summer 1979, will contain detailed national cost and employme on 16 solar-related technologies (see exhibit 1). The cost esti parameters developed for this data base were based primarily on supplied to SERI by DOE national laboratories (e.g., Argonne, Lo Lawrence Berkeley Laboratories, Oak Ridge). This information in

- o Capital Cost -- Estimated capital cost for 16 solar are contained in this data base. These costs are p years 1975, 1985, 1990, and 2000 and are expressed 1972 dollars per 10^{12} Btu output. Subsequently, ca cients are developed to coincide with those INFORUM supplied the necessary inputs for the construction facility.** The data base can be readily matched w BEA sectors, to be used for similar input-output ap

- o Operating and Maintenance Costs -- O&M cost estimat for 14 of the 16 solar technologies in the SERI dat mates were not developed for the passive solar and stoves technologies. As with the capital costs, th given in millions of 1972 dollars per 10^{12} Btu outp disaggregated by

  INFORUM sector.* These estimates, however, assume distribution of O&M costs among input sectors remai time. Therefore, technical coefficients do not cha projected years 1975, 1985, 1990 and 2000.

- o Labor Requirements -- This information will be avai SERI documentation.

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*The summary provided here is based on a report by CONSAD, op. c
**INFORUM is a 200-sector input-output model, designed to produc projections over a 10 to 15-year time horizon. See part 2, sect

1. Active Solar
2. Passive Solar
3. Solar Thermal

<u>Agricultural and Industrial Process Heating (AIPH)</u>

4. Parabolic Dish AIPH
5. Parabolic Trough AIPH
6. Flat Plate AIPH

<u>Photovoltaics</u>

7. Residential Photovoltsics
8. Centralized Photovoltaics

9. <u>Large Wind Energy System</u>

<u>Collection System</u>

10. Agricultural/Forestry Residue Collection
11. Biomass Farm Production
12. Municipal Solid Waste Electric Utility

<u>Conversion Systems</u>

13. Manure Gasification - Anaerobic Digestion
14. Agriculture/Forestry Gasification Pyrolysis
15. Biomass Wood Stoves
16. Biomass Electric Utility System

documentation of each solar technology. As previous
SERI is expected to be publishing a background docum
data base by spring 1979. This report will specify
facility size.

- Operating Life of the Facility -- This information i
the SERI data base.

- Materials Requirements -- This information is not in
data base, but it will be available as part of the b
documentation.

- Technological Change/Input Substitution -- As indica
data base provides estimates of capital coefficients
sectors for the years 1975, 1985, 1990 and 2000.* C
coefficients are projected over this period. Thus,
can be used to estimate input substitutions occuring
technology.

Availability and Cost of Information. Following approval by
Energy and publication (sometime in fall 1979), this data base wi
for public use. Cost of data is not yet determined.

Contact:

(for employment information)
Gregg Ferris: 303/231-1077
SERI
1536 Cole Boulevard
Golden, Colorado 80401

(for cost information)
Michael Yokell: 303/231-1060
SERI
1536 Cole Boulevard
Golden, Colorado 80401

*INFORUM is a 200-sector input-output model, designed to produce
projections over a 10 to 15-year time horizon. See part 2, secti

H. The U.S. Department of Commerce, Bureau of Economic Analysis, (BE
ares earnings and employment data as part of its Regional Economic
rmation System (REIS), available upon request. Most of this data is u
t into the Regional Industrial Multiplier System (RIMS), which is desc
art K of this section. The BEA can provide both historical data and
ections to 2020.

Historical Data:

- Personal Income (e.g., labor and proprietors income, social insura contributions, interest, dividends, rent and transfer payments) by county, state and for the nation. Available for 37 sectors at the level (see table C-3 in appendix C) and 16 sectors at the county level.* State data is available for selected years 1929-1958, and consecutive years 1957-1977. County data is available for selecte years 1929-1965 and consecutive years 1966-1977.

- Employment by county, state and for the Nation. Available for 37 sectors at the state level and 16 sectors at the county level. St data is available for 1967-1977; county data is available for 1967 (consecutive).

Cost of Information

Individual tables:	$1 per county or state and
	$1 per table with a
	$5 minimum
	$50 (maximum) for all counties in a state
	$50 for National total
	$1,000 for one table for all counties and states and the United States total.

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*se sectors are: farm, agricultural services/forestry/fisheries, minin truction, non-durable manuf., durable manuf., transportation and publi ities, wholesale trade, retail trade, finance/insurance/ real estate, ices, Government and Government services (Federal, civilian, military, local).

Mail Stop BE-55
Bureau of Economic Analyses (BEA)
Washington, D.C. 20230

The BEA also publishes a nine-volume set of publications entitled L
ea Personal Income, 1971 to 1976, which contains estimates of total pe
come, population, per capita personal income, components of personal i
pe, and labor and proprietors' income by major industries for all Unit
ates counties, the District of Columbia, SMSA's, BEA economic areas, s
d the Nation. These volumes are available from:

National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

Cost of Information.

The price for the nine-volume set is $75; the Accession number is P
163-SET. Titles, Accession numbers and prices for individual volum
follow:

Vol. 1:	Summary, PB 291 164	$11.00
Vol. 2:	New England Region, PB 291 165	$ 5.25
Vol. 3:	Mideast Region, PB 291 166	$ 6.50
Vol. 4:	Great Lakes Region, PB 291 167	$10.75
Vol. 5:	Plains Region, PB 291 168	$12.50
Vol. 6:	Southeast Region, PB 291 169	$16.25
Vol. 7:	Southwest Region, PB 291 170	$ 9.25
Vol. 8:	Rocky Mountain Region, PB 291 171	$ 6.50
Vol. 9:	Far West Region, Including Alaska and Hawaii, PB 291 172	$ 6.50

ployment. Projections of total employment to 2020 by BEA economic
ea (see figure 3 in section I) are available in:

1972 OBERS Projections, Volume 2: Concepts, Methodology, and Summary Data. 1974)* This document is available from the United States Government Printing Office, Superintendent of Documents, Washington, D.C. 20402 (202/275-3050). Cost: $2.50

rnings. Projections of earnings (i.e., wages, salaries, and oprietors income, accounting for about 80 percent of Personal Income) 2000 for states by 37 industrial sectors are available from BEA. ntact:

Gene Janisch (202/523-0958)
Regional Economic Analysis Division
Mail Stop BE-61
Bureau of Economic Analysis
Washington, D.C. 20230

dition, projections of earnings for 1980, 1990, 2000, 2010, and 2020 es by 16 industrial sectors are available for the states listed below. mation can be ordered from:

National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, Virginia 22161

the ordering information shown:

: Projections, Economic Activities in...

ia	PB 264 580	$9.75
Carolina	PB 264 581	$5.50
cky	PB 264 582	$9.00
Carolina	PB 264 583	$7.75

document also include earnings and income data which has been ly updated by BEA. The sources for this updated data are listed

Virginia	PB 264 585	$
Mississippi	PB 264 584	$
Tennessee	PB 260 538/AS	$
Florida	PB 260 537/AS	$(
Alabama	PB 260 536/AS	$(
Summary	PB 265 473/LL	$(

Microfiche copies are $3 each.

The above employment and earnings projections were develo contractual arrangement. BEA is preparing updated projections this year. Earnings and employment will be projected in 58-i population by age and sex, and income by source. The results for states, SMSA's, BEA economic areas, and "state-pieces" of regionalizations. These projections are described in:

> The BEA Regional Projections Program: An Overview Kenneth P Johnson, U.S. Department of Commerce, Bur Analysis, Regional Economic Analysis Division, Wash 20230.

I. Bureau of Labor Statistics Data Files. Current data earnings by industry in state and metropolitan labor markets from two primary sources: The Current Employment Statistics operated on a cooperative basis between the Bureau of Labor S of Labor and the State Employment Security Agencies throughout the ES-202 Reporting System which provides data on employment covered by the State Unemployment Insurance laws. The BLS 79 ment, hours and earnings estimates are available only for the and 220 major metropolitan areas while the ES-202 data are av

The BLS 790 industry employment estimates are based on m employment in firms in major industries throughout each state from these employment sample surveys are inflated by appropri estimate total non-agricultural payroll employment in major i nation and for the 50 states. The industry payroll employmen nation as a whole, the individual states, and major SMSA's ar Employment and Earnings, a monthly publication of the U.S. De

In addition, the State Employment Security Agencies publish month
a on their estimates of non-farm payroll employment for both the st
le and for selected major metropolitan areas throughout the state.
t data for the manufacturing sector are generally broken down by tw
ndard Industrial Classification (SIC) codes since the sample size f
ufacturing sector in the survey is large enough to justify such dis
n. Payroll employment estimates for the remaining sectors are prov
highly aggregated form due to sample size limitations.

Sources of this type are described in greater detail in:

<u>A Manual For CETA Prime Sponsors</u>
<u>Second Addition</u>, December 1976
National Civil Service League
5530 Wisconsin Avenue
Washington, D.C. 20015
(202) 654-8864
Cost: $45 per copy

<u>Economic/Demographic Assessment Manual</u>
J. A. Chalmers and E. J. Anderson
November 1977. Copies are available,
<u>free of charge</u> from:

Bureau of Reclamation
Engineering and Research Center
Denver Federal Center
Post Office Box 25007
Denver, Colorado 80025
Attention: 922 (Contact: W. W. Reedy,
Division of Planning Technical Services)

Individual data tapes with the finest level of industry and geogr
ail on employment and earnings are also available from the <u>Bureau o</u>
<u>tistics (BLS)</u>. These include:

- <u>Industry Employment, Hours and Earnings - National</u>. For all employees, women, and production or non-supervisory workers nearly — <u>Cost</u>: $110

industries at various levels of aggregation. About 1,300 published monthly series are available for production workers average earnings. Hours and earnings are available for more than 350 industries. Most series begin in 1958, although some are available from 1909.

- Industry Employment, Hours, and Earnings - State and Area. For total payroll employment, over 8,800 series of monthly data are available; they cover each state and 227 major labor areas (most of which are SMSA's). About 10,000 monthly series covering workers average earnings for each state and 192 major labor areas, beginning in 1947 or later. In the largest states, up to 170 industries are reported. Some industry detail at the 4-digit SIC level is available for recent years.

  Cost: $2

- Industry Employment and Wages (Covered by Unemployment Insurance laws). Two files are available: A historical file and a six-quarter file. The historical file contains national and state summaries of monthly employment, quarterly wages, and a number of reporting units by 1972 SIC industry. National summaries are available for 84 two-digit, 423 three-digit and 451 four-digit manufacturing industries. State summaries are available for 84 two-digit industries. These series begin in 1975.

  Cost: de upon the specific

  The six-quarter file contains state summaries, for the most recent six quarters, of monthly employment and quarterly wages. The summaries are available for 84 two-digit and 423 three-digit industries and for 1,004 four-digit industries.

s Handbook for Methods for Surveys and Studies. U.S. Department of
bor, Bureau of Labor Statistics (1976) Bulletin 1910.

Note: Chapter 3 - "Employment Hours and Earnings"

Chapter 9 - "Employment and Wages Covered by Unemployment Insurance Laws"

ntact: Carol Utter (202) 523-1146
Bureau of Labor Statistics
Office of Employment Structure and Trends
Division of Current Employment Analysis

ble 5 provides a useful conversion chart of the various data categorie Federal sources. With this chart, researchers can convert census sur ies to sectors corresponding to the major group divisions of the SIC a sectors on which the BEA reports personal income, wages and salaries, reports employment and labor force statistics.

re must be taken, however, in comparing census employment data with da ther BEA or the state employment agencies, since each is defined ntly. The conceptual differences among these series principally have (1) whether employment is counted on a place-of-work or place-of- ce basis; (2) whether employment is counted as the number of jobs or t of employed persons; and (3) whether employment counts only non-agri- l wage and salary workers covered by unemployment insurance compensati udes agricultural workers, proprietors and uninsured workers. The nces among these series are explained in more detail in:

Economic/Demographic Assessment Manual
J. A. Chalmers and E. J. Anderson
Available from the
Bureau of Reclamation
Engineering and Research
Denver Federal Center
Denver, Colorado 80225
Attention 922 (pages 48-51)

The Bureau of Census, U.S. Department of Commerce, is an excellent of information on employment and earnings. Detailed profiles of the

Mining	Mining	Mining
Manufacturing (all types)	Manufacturing	Manufactu
Railroads, Railway Express Service, Trucking and Warehousing Service Other Transportation, Communications Utilities & San. Serv.	Transportation, Communications, and Public Utilities	Transport
Wholesale Trade	Wholesale & Retail Trade	Wholesale
Food, Bakery & Dairy Stores Eating & Drinking Places General Merchandise Stores Motor Vehicle Retailing & Service Stations Other Retail Trade		Retail Tr
Banking & Credit Agencies Insurance, Real Estate & Other Finance	Finance, Insurance, and Real Estate	Finance
Business Repair Services Private Households Other Personal Services Entertainment & Reception Services Hospitals Health Serv., except Hospitals Schools & Colleges (pvt.) Other educational & Kindred Serv. Welfare, religious & Non-profit Membership Organizations Legal, Engineering & Misc. Professional Serv.	Services	Services
Public Administration Schools & Colleges (Govt.)	Government: Federal, Civilian, Military, State & Local	Governmer

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Source: Impact Analysis and Local Area Planning: An Input/C
A. Harvey Block, Center for Community Economic Devel
(Cambridge, Massachusetts 1977)

occupations and industries of the employed labor force are presented i
iderable detail, including the occupational composition of employment
r industries of the SMSA's, SMSA counties, central and metropolitan ci
Detailed Characteristics volumes also report on the earnings of worker
ous occupations and industries, including breakdowns of the occupation
stry earnings data for various age, sex, and race groups.*

The Bureau of Census also publishes County Business Patterns, a serie
ications produced each year since 1946 that presents
t quarter employment and payroll statistics by county and industry
each state. Information is provided on the number and type of
rting units, payroll and employment by industry classification and
ty location. These reports are available from the Superintendent of
ments, U.S. Government Printing Office, Washington, D.C. 20401.
report (there is one for each state) costs less than $10.

It should be noted that County Business Patterns includes only data f
oyment covered by social security, derived from employers' quarterly p
returns. Thus, government employees, self-employed persons, farm work
domestic service workers are excluded. In 1973, County Business Patte
oyment data accounted for about 75 percent of total United States empl
urban counties and SMSAs, the major exclusion is government employment
rnment agencies should be able to provide this supplemental informatio
icular, each state department of labor in 1977 published a directory o
lable state statistical series. This directory shows what data exist
oyment, wages, and unemployment by available level of geographic, indu
occupational detail, and the frequency of publication.

Census employment/earnings information is also available on data tape
the Bureau of Census.** The County Business Patterns data for 1974 t

---

example see: U.S. Department of Commerce, Bureau of Census, Detailed
acteristics: Massachusetts, PC(1)-D23, table 180, "Occupation of Empl
ons by Industry Group and Sex," pp. 894-833, Washington, D.C., U.S.
rnment Printing Office, October 1972. The occupation-industry data fr
Census are primary inputs into the 1976-1985 occupational forecasts f
es and SMSA's developed by about 20 State Employment Security Agencies
ughout the Nation. Other states utilize data from the Occupational
oyment Statistics survey for projection purposes.

e reports for County Business Patterns provide summary data for all SI
stries in the county with 50 or more employees. The data tapes provid
for all SIC industries.

Customer Services Branch
Data User Services Division
Bureau of Census
Washington, D.C. 20233
301/763-2400

K. Use of Regional/National Models. The direct employment ef of an energy project can also be estimated using existing regional models. There are several types of models used to estimate the emp effects associated with some change in a local or regional economy. models discussed here are export base and input-output models. The discussed in greater detail in part 2 of this section. The purpose section is to briefly describe the procedure for determining direct effects using these models, and present the sources and costs for t information.

(1). Export Base Models. There is only one export base model reliable estimates of the direct employment requirements for energy directly in the data base. This is the Social and Economic Assessm (SEAM), developed by Argonne National Laboratories. A highly simpl diagram in figure 4 illustrates the four major components of SEAM, requirements, output and interrelationships.

(1a). The SEAM model first projects the annual change in the population of the subject county (or combination of counties) by ag race to the year 2000.** The user then inputs the type of technolo introduced into the county and the year in which construction will model determines the annual direct construction and operation emplo ments for that particular technology and estimates the lagged secon ment effects using employment multipliers constructed from data on cular county or counties.*** Direct employment requirements are es

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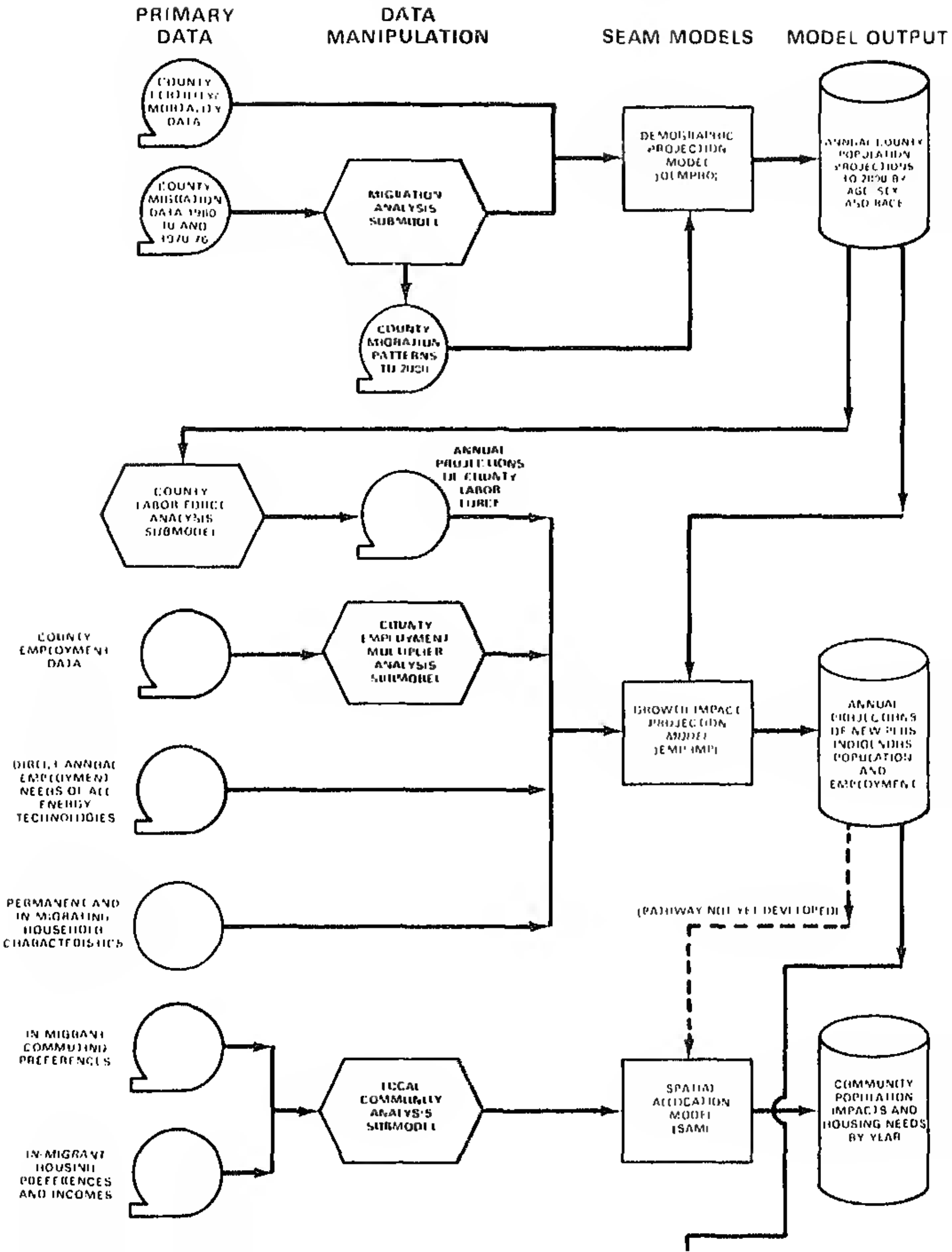
*This information is in the "population file" of the Sixth Count Summary Table, 1970 Census.

**The data base includes all countries on the mainland United State the State of Virginia.

***See part 2 for discussion of these multipliers.



PRIMARY DATA
DATA MANIPULATION
SEAM MODELS
MODEL OUTPUT
COUNTY MIGRATION ANALYSIS SUBMODEL
MIGRATION ANALYSIS SUBMODEL
COUNTY MIGRATION PATTERNS
DEMOGRAPHIC PROJECTION MODEL
COUNTY LABOR FORCE ANALYSIS SUBMODEL
ANNUAL PROJECTIONS OF COUNTY LABOR FORCE
COUNTY EMPLOYMENT DATA
COUNTY EMPLOYMENT MULTIPLIER ANALYSIS SUBMODEL
DIRECT ANNUAL EMPLOYMENT NEEDS OF ALL ENERGY TECHNOLOGIES
PERMANENT AND IN-MIGRATING HOUSEHOLD CHARACTERISTICS
GROWTH IMPACT PROJECTION MODEL
ANNUAL PROJECTIONS POPULATION AND EMPLOYMENT
(PATHWAY NOT YET DEVELOPED)
IN-MIGRANT COMMUTING PREFERENCES
IN-MIGRANT HOUSING PREFERENCES AND INCOMES
LOCAL COMMUNITY ANALYSIS SUBMODEL
SPATIAL ALLOCATION MODEL
COMMUNITY POPULATION IMPACTS AND HOUSING NEEDS BY YEAR

1. Coal Extraction Activities (county-specific)
2. Coal-Fired Plant (Base Plant Construction and O&M only)
3. Nuclear Plant (PWR) (Base Plant Construction and O&M only)
4. Oil Plant (Base Plant Construction and O&M only)
5. Gas-Steam Plant (Base Plant Construction and O&M only)
6. Combined-Cycle Base Plant (assumed similar to coal-fired plants)

The estimates for electric power facilities are based on a joi manpower study entitled Forecasts of Cost, Duration and Manual Man- Requirements for Construction of Electric Generating Plants 1977-19 study examines annual craft requirements to construct all planned a progress electric powerplants for a range of sizes for each type of capacity. It also provides work-year schedules for the coal, oil a technologies with a capacity base size of 500 megawatts and constru of 4 years.** For nuclear facilities, a base capacity size of 800- used with a standard construction duration period of 6 years. Thes are input to the Employment Impact Projection Model (EMPIMP) compon SEAM. The EMPIMP can compute a new schedule when the specified meg size is greater (or less) than the base capacity size.

The SEAM model also computes available labor force for these e facilities by subtracting the county-specific labor work force part rates (by age, cohort and sex), from the corresponding national fig to obtain the percentage of unemployed in the local work force who sufficient jobs existed, be available to work. The model also dete household labor force characteristics of transitory workers, how ma workers and households will move into the area. This component of also permits estimations of the potential demand for residential ho of housing in the communities accessible to the facility. Finally, determines, for each year of plant construction and operation, the requirements for public services and facilities (e.g., schools, rec policy, fire) needed to accommodate the new population and the annu and operating costs of providing this infrastructure.

---

*Estimates are all provided for the incremental periods of 1975-1985 and 1985-1990.

**The data base for this study was based on the Construction Manpow System (CMDS) described in part 1.F.

del further assumes that in-migrants are the first to be released for workers is reduced.

imitation to this model is that it assumes zero labor competition experiencing energy development and its adjacent counties. Thus, ng industrial development is explicitly included, the SEAM model at none takes place. If, in fact, industrial development is e county (or adjacent counties) for which local labor is qualified, overstate labor availability and the direct employment effects h the energy system in question.

tors limit the model to compute only rough employment trends. the SEAM model is, to date, one of the most comprehensive and ilable for analysis at the county level.

ork is presently underway to include important variables to the ill make its forecasting much more accurate and useful to the nmaker. Argonne National Laboratory is also in the process of eric solar energy systems as input into the SEAM model.

ability of Information:

t, there is no official procedure for the use of SEAM by other than Argonne National Laboratories and the Department wever, the direct labor requirements of a particular facility can ree of charge, from the following persons:

J. Stenehjem
gy and Environmental
stems Division
nne National Laboratory
South Cass Avenue
nne, Illinois 60439
) 972-3754

Roger Shull
Ronald Matheny
ronmental Impacts Division
USDOE
ington, D.C. 20545
) 353-3311

Assumptions and Limitations," MIMEO. Erik J. Stenehjem, E
Environmental Systems Division, Argonne National Laborator

"Summary Description of SEAM: The Social and Economic Ass
technical memo ANL/IAPE/TM/78-9. Erik J. Stenehjem, Argon
Laboratories. Energy and Environmental Systems Division.

"A Framework for Projecting Employment and Population Chan
Energy Development Phase I and II," (Draft) Erik J. Steneh
Metzger. Energy and Environmental Systems Division. Augu

(2). Input-Output Models. Input-output (I-O) models pres
interindustry description of the national or regional economy.
models are based on detailed industry-by-industry survey data.
models can also be based on regional survey data, but are usual
simple "top down," non-survey adaptations of national models.*

For both types of I-O models, employment/income effects ne
"localized." That is, there needs to be a procedure for determ
of employment/income that is retained within the region, given
final demand for the output of an energy sector (or any other i

The general procedure for "localizing" direct employment a
effects in input-output models is as follows:**

(a). Determine the industry sector(s) affected by the ene
project and estimate the dollar level of final demand for each
This step involves:

---

*A "top down" approach determines regional trends or impacts by
allocating national patterns to regional and state levels. An
tive approach is to use regional data as input for a specific r
model, as in the case of survey-based state I-O models. Using
from specific and independent models to determine results for a
aggregated region is often called the "bottom-up" approach. Se
2, section (D)4 for further discussion of non-survey models.

**For a detailed description of how nuclear powerplant requirem
"localized" for the Phildelphia SMSA region, see: Regional Eco
Nuclear Power Plants by W. Isard, T.A. Reiner and R. Van Zele (
Available from Brookhaven National Laboratory, Upton, New York.

requires purchases from the sawmill, concrete products, rea concrete and diesel fuel industries.* The process of break down an energy project (or any other investment) into prima purchases is usually referred to as developing a bill of go the investment.

o Converting the direct output changes into final demand chan sector. This usually involves removing wholesale or retail and transportation margins from the sales figures and alloc them as final demand to the trade and transportation sector

(b). Determine which industries are present in the region. In case articular industry input is required, but not produced in the region, ut (and industry) is deleted. In effect, this assumes that the input orted.

(c). For the remaining industry sectors determine whether there is ficient local production in a given supplying industry to permit local chase of the input. This can be done using a location quotient. Loca tients are measures of the degree to which a region produces the indus put it needs. For a given industry, the location quotient (L_i) is the lustry's proportion of regional total earnings or employment divided by e proportion for the Nation.***

$$L_i = \frac{e_i/e}{E_i/E}$$

where e_i is earnings/employment in the region in industry i.

---

egional Employment and Income Effects of a 50--MW Wood-Fired Powerplant eter VanderWerf. Theyer School of Engineering, Dartmouth College, Hanc Hampshire 03755 DSD #90.

See: The Use of Input-Output Analysis, Regional Development and Plan aluation, U.S. Department of Agriculture. Agriculture Handbook No. 530 -72. Also, see: Net Energy Analysis: Handbook for Combining Process out-Output Analyses by Clark Bullard et al. CAC Document No. 214, Cent vanced Computation, University of Illinois (Urbana Champaign; 1976).

*Note: For national analysis, L_i would be equal to one.

represents 2.5 percent of United States total earnings. For the midwe
SMSA, assume that 4 percent of earnings in the region originate in thi
According to the formula above, the location quotient is 1.61, that is
midwestern SMSA produces more food and kindred products than it needs
exports the excess. Hence, for each dollar of final demand in that in
all of it can be met by local production. The location quotient is 1.
application described below (i.e., it will never be greater than 1.0 w
in I-O analysis). If, on the otherhand, only 1.5 percent of earnings
midwestern SMSA originated from this industry, the location quotient w
only 0.60. This implies that the region can only meet 60 percent of f
demand in that industry through local production. It imports the rest

Multiplying the total change in final demand by this location quo
yields the final demand change for the region by sector:

For each sector:

Change in Final Demand ($1,000)	x	location quotient	=	Change in Final Demand Within Region ($1,000)

In many regional models, the change in final demand within the re
presented as a "direct effect coefficient."

$$\text{Direct effect coefficient} = \frac{\text{Change in Final Demand Within Region (\$1,000)}}{\text{Change in Final Demand (in \$1,000)}}$$

(d). The change in final demand (or the direct effect coefficie
for the region is then multiplied by the direct employment coefficient
person-years per dollar of output) for the relevant sector. This yiel
change in direct regional employment (in person-years) due to a change
demand for inputs:

The direct employment effects can be translated into earnings
) using the appropriate earnings/employment ratios:

ector:

.oyment)	x	Earnings/Employment Ratio	=	Direct Earnings Effects

natively, earnings associated with direct employment effects can be
using earnings/output ratios:

ector:

'inal Demand gion (from (c))	x	Earnings/Output Ratio	=	Direct Earnings (income effects)

input-output models have this basic format for determining direct
effects.* However, they differ in the level of industrial sector
, in particular, the level of energy sector disaggregation. Below is
national/regional I-O models that are available, with a description of
onal and sector disaggregation, and references for further information
peration and use.

The Brookhaven National Laboratory Input-Output Model (BNL/I-O) is a
I-O model of the national economy, with total output employment and
orecasted for 1985.** The BNL/I-O model can be linked to a linear
; submodel of the energy sector and/or to macroeconomic models that
inal aggregate demand (see part 2). The 110 sectors are listed in
n appendix C. The model currently includes 8 energy end-product

---

exceptions are I-O models tied to demographic models, where the
: force is actually projected and "matched" to the labor requirements
with a new basic industry (such as energy). See, for example, the
of the REAP model, section K(2c) below.

:-O model was developed in collaboration with the Center for Advanced
1 at the University of Illinois, Urbana, IL.

technologies. This work will be completed by late spring 1979.

Availability and Cost of Information:

- Earnings and Employment/Output ratios for the 110 nation forecasted to 1985 are available, free of charge, from:

  Paul Cronckl (516/345-2071)
  Joan Lukachinski (516/345-2249)
  Brookhaven National Laboratories
  Upton, New York 11973

- National Industry-Occupational matrix for 110 sectors an occupations are available, free of charge, from:

  Paul Groncki/Joan Lukachinski
  (see above)

(2b). Regional Industrial Multiplier System (RIMS). The R designed to estimate regional impacts of changes in final demand of industries, and is used primarily to analyze site-specific im from energy-related activities. The model generates estimates o indirect/induced changes in output, earnings and employment for industrial sectors. As in the case of the BLS I-O (see below), technologies, conservation methods and other "unconventional" en must be broken into direct inputs and assigned to appropriate in Appendix B refers the reader to recent attempts to incorporate s and conservation measures into the I-O framework. RIMS multipli from the production relationships listed in the 1967 BEA Nationa Table. They are provided for each of the 173 BEA economic areas in section I) and have been used to derive multipliers for every nine census regions. The state and census models disaggregate m effects into 103 industrial categories. The census model also c aggregated industries (see table C-5 in appendix C).

Availability and Cost of Information:

- National earnings - output ratios and direct-effect coef by BEA region are available for 56 aggregated sectors in

more than 56 sectors, the cost of obtaining information on direct eff BEA regions *is the same as* obtaining information on direct, indirect, uced effects (see part 2, section D(4b)).

erences:

Selected Analytical Data for Regional Impact Analysis: Procedure Us Guide to Application, prepared for FEA by the Regional Economic Anal Division, BEA, U.S. Department of Commerce, September 1976.

The Economic Impact of Oil Resource Development on the Alaskan Econo 1975-85, FEA/B-76/082, prepared for FEA by the Regional Economic Ana Division, BEA, U.S. Department of Commerce, September 1975.

Guideline 5 Regional Multipliers, Regional Economic Analysis Divisio Bureau of Economic Analysis, U.S. Department of Commerce, January 19

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price: $2.00 Stock No. 052-045-000-48-7.

sonal Contacts:

Joseph Cartwright (202) 523-0594

Regional Economic Analysis Division
Bureau of Economic Analysis, BE-61
Department of Commerce
Washington, D.C. 20230

David Sandoval - Department of Energy
Room 6119, 12th and Pennsylvania Avenue
Washington, D.C.

(2c). The North Dakota Regional Environmental Assessment Program (R vides baseline and energy project impact projections for a 15-county a tern North Dakota. Outputs are available at the county and municipal include such variables as employment by type*, population by age and

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pes of employment in this model are: construction, operation, indirec igenous (i.e., baseline) jobs.

rsonal income also are available at the regional level). The REAP mo
ntains five basic submodels: an input-output economic model, a demog
del, an economic-demographic model interface, a residential allocatio
d a fiscal impact model.

The REAP input-output model provides baseline projections of gross
lume from which employment requirements by each of 13 sectors are der
ble C-6A in appendix C). The user must select the energy projects s/
cluded in the energy development scenario to be evaluated. The model
set of 31 projects which are various possible configurations of expor
al-fired thermal electric generating plant or substitute natural gas
aracteristics. Characteristics (including direct labor requirements)
pical plant of each type are presented in tables C-6B to C-6D in appe

The REAP demographic model provides projections of population by a
x and an estimate of the available labor force. The interface compon
e projections of required employment from the input-output model with
ojections of available labor force from the demographic model to dete
vel of employment needs that can be met by the indigenous population
at must be met by the in-migration of new workers for each county and
lity. The residential allocation model estimates the settlement patt
w workers and their families and the fiscal-impact model provides pro
the changes in public sector costs and revenues resulting from the a
onomic and demographic changes. The REAP model can be used to provid
ed conclusions about energy development in the western states, but is
propriately applied to the specific, 15-county area. Other regions c
rchase the model and adapt it to their regional economic and demograp
aracteristics (see part 2, section D(6)).

st of Information:

o Direct labor requirements and annual expenditures for 31 energy projects	Free of charge, Contact: Glen Schaible (see be

ferences: (available free of charge)

The REAP Economic-Demographic Model: Background Structure and App
by F. L. Leistritz, et al., prepared for U.S. Department of Energy
Dakota Regional Environmental Assessment Program.

(February 1978).

er Handbook (and Updates). Available from Director of User ND-REAP, 316 N. 5th Street, Suite 521, Bismarck, North Dakota

cts:

chaible
Coordinator
Environmental Assessment Program
, 316 N. Fifth Street
North Dakota 58505
3700)

e Bureau of Labor Statistics Input-Output Model (BLS/I-O) provides ates of total output by sector and total employment by sector and the years 1980 and 1985 for alternative assumptions.* The I-O on the 484-sector matrix developed by the BEA, and has been o 129 industrial sectors by the BLS.

first determines the levels of output in 129 sectors required to ific forecast of final aggregate demanda.** Sectoral employment n estimated, based on projected employment/output ratios for each ectors are listed in table C-7 in appendix C, together with the industry codes from the Standard Industrial Classification (SIC). oyment/ output ratios used to estimate employment changes are also e table. Note that the model includes final demand sectors for

---

ided by the BLS gives the user the option of choosing alternative de oil and alternative scenarios regarding economic conditions esent and 1985.

sts are usually derived from the output of a macroeconomic tput is then used as input into the BLS I-O model. See, for Input-Output Simulation Procedures" technical memo TM/IA/78-03, Analysis Division, Energy Information Administration, U.S. Energy (July 31, 1978).

Availability and Cost of Information:

- Earnings and employment/output ratios for 129 industries ar from BLS on data tape for 1970, 1980, 1985 and 1990. The d includes input/output coefficient matrices; total final dem components, civilian employment; and wage and salary employ output series by industry with additional annual data for l Cost: $100.

  Individual tables on national employment and output can als free of charge, from:

  Charles Bowman (202) 523-9036
  Bureau of Labor Statistics
  GAO Building, Room 4860
  Washington, D.C. 20212

- National industry-occupational matrix for 260 industries an occupations is available on data file from BLS. For each i occupation cell, three data items are provided--employment of employment to occupational total, and ratio of employmen total.

  Matrices are available for 1970, 1976 and 1985 (projected). Industry-occupational information for national employment i available, free of charge, from:

  Neal Rosenthal (202) 523-1765
  Bureau of Labor Statistics
  441 G Street, NW.
  Washington, D.C. 20212

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*A joint effort by DOE and BLS is underway to develop a sectoring p energy perspective, which would isolate energy producing industries consuming large amounts of energy and industries consuming large am energy per output. The Energy Disaggregated Input/Output (EDIO) mo disaggregate the electric utilities sector into fossil fuel, nuclea "other" sectors. The EDIO model is currently under development.

a detailed discussion of the methods and data utilized by BLS in the
:ion of the entire BLS/I-O model, see:

U.S. Department of Labor, Bureau of Labor Statistics, Office of Economic Growth, "Methods and Data Sources: BLS Revised 1980 and 1985 Projections," unpublished monograph, April 1977.

BLS data files, write to:

U.S. Department of Labor
Bureau of Labor Statistics
Division of Planning and
Financial Management
441 G Street, NW.
Washington, D.C. 20212

: 2. Indirect/Induced Employment and Earnings Effects. The simplest
: costly approach for determining the secondary employment and earnings
of energy alternatives is to use the national estimates provided in
institutional studies and/or contact individuals who have worked with
oes of information (see Part 1, sections A and B above). While this
is an appropriate starting point, it may be very inaccurate in
is where (1) an impact analysis is needed and the secondary effects for
ular region are significantly different from the national effects, or
cision between energy alternatives must be made and each has very
: secondary effects on the local economy.

alternative approach is to use a form of multiplier analysis which is
to the region and energy technology in question. Multiplier analysis
the effects of a change in spending in one part of the economy on
onomic activity in the region. For example, suppose an electric power-
to be built in region A. Some fraction of the money spent on wages,
and equipment for building and running the plant will go to local
businesses, and some of this increased income will, in turn, be spent
ocal economy. As a result, retail merchants and other local business
il enjoy higher sales. The expanded payrolls will be spent on basic
tems such as food, clothing and housing. Hence, the original dollar
ures for the powerplant may generate two or three times as much income

indirect/induced effects can be easily estimated as the difference
total (multiplier) effects and the direct effects discusaed in part
approaches used most frequently by regional economists for thia pur
export-base multipliers, using either income or employment, and inp
models.*

A. Export base multipliers: A general description. The unde
theory of export base** is that exports are the moving force that d
the total level of local economic activity. The logic goes like th
from export activity is determined mainly outside of the local econ
sales generate labor and business income which, in turn, generates
local economy. Some of this income is spent in the local economy o
of goods and services, thereby generating still more income/employm
region. In other words, if income or employment from export sales
the total income/employment will be multiplied.

Export base theory assumes all economic activity in a region t
into two sectors: the export sector produces goods and services co

---

*Econometric models, a third approach, depend less on export-base t
define employment as a multivariate function of several explanatory
whose coefficients are estimated with regression equations. This a
overcomes many of the problems associated with multipliers. Unfort
are expensive to develop and with few exceptions have not been effe
applied to energy policy choices. A recent report by the Council o
Planning Agencies estimates that Wiaconsin and Arkansas have each s
$300,000 in developing an econometric model. This cost does not ev
the salary and overhead costs of State personnel involved in the ef
for purposes of this report, only the export base multipliers and i
models will be discussed in detail. For further information on eco
models, see: Econometric Analysis of Regional Systems, Norman J. G
(Academic Press, 1977). For one of the few energy applications of
model, see: Forecasting Regional Economic Activity: The Tennessee
Model, by Richard Gustely, Center for Business and Economic Researc
Business Administration, University of Tennessee, Knoxville, Tennes
1978)--Chapters III and IV.

**Export base theory is also often referred to as economic base the
The two terms are synonomous.

here are three major variations to the export base multiplier approac
nt or simple ratios, complex ratios, and regression coefficients. Us
e ratio gives a picture, at one point in time, of the relationship o
ndustry to non-basic, or service industry activity. The simple equa
s relationship is:

$$MV = \frac{TE}{BE}$$

V is the multiplier value, TE is total employment and BE is basic
ent.

e underlying assumption in simple ratios is that all employment in t
ed sectors is assumed to be basic. Mining, construction, agricultur
ufacturing are usually assumed to be basic, although other assumptio
lude such sectors as transportation. This normally results in an un
nt of the real value of the multiplier by the portion of economic ac
basic sectors that is actually local service oriented. This particu
is best used for areas with large, relatively stable economies, or w
ave poor input data.

e complex ratio differs from the simple ratio in the definition of b
ent. Each sector can have both a basic and non-basic employment com
h the simple and complex ratios, however, the basic/non-basic mix fo
point in time is assumed to remain the same throughout the assessmen

e regression multiplier allows estimation of individual multipliers
h basic employment category. Unlike the simple and complex ratios,
ion multipliers provide for more than just a one time period picture
ent. Regression equations can be used to measure the effects of tim
ze, construction phase and economic base changes. Due to increased
lity, these multipliers can be applied to areas which are undergoing
and/or have a small economy.

alternative to using employment is to use income directly in comput
tiplier. Use of an income multiplier has one major advantage: it m
ces for the difference in wage rates paid for various types of emplo
nately, most available income data is out of date (e.g., BEA and BLS
least a 2-year lag) and industry or business sources are reluctant t

Export base multipliers have the advantage of being relatively simp[le in] theory, construction and use. As a result, it is relatively inexpensive [to de]velop these multipliers: According to one estimate,* the study of a [com]munity with 25,000 employees would cost less than $5,000, a figure we[ll wi]thin the range of community budgets of cities of that size. However, [there ar]e several significant conceptual and technical drawbacks to the use of [mul]tipliers in assessing the effects of energy choices:

1. Problems in identifying basic and non-basic sectors can detract from the accuracy of the forecasts. Several methods used impli[citly] assume uniform national consumption and production patterns, or all local demand is met by local production.**

2. The assumption of a constant basic/service ratio may not prove in the long run due to import substitution that accompanies reg[ional] growth. This is particularly relevant for an energy project, w[hich is] expressly undertaken for the purpose of substituting imported e[nergy] with local energy sources.

3. The multiplier, as an average for the basic sector as a whole, be applicable to a particular industry or energy project. The of a given industry or energy project on a region will be depen[dent on] its propensity to consume locally produced intermediate product[s and] the consumption habits of its employees.

This last restriction implies that all energy projects that fall in[to a spe]cific basic sector (e.g., construction) will have the same indirect/i[nduced eff]ects under this method of analysis. In effect, comparisons among ene[rgy alt]ernatives (policy question 2) based on <u>total</u> employment/earnings effe[cts are] no more enlightening than comparisons based on <u>direct</u> effects alone. [The] use of exportbase multiplier analysis is really only appropriate for [ass]essing the total impact of a policy decision to develop a particular [energy sou]rce (policy question 1).

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*[Th]e <u>Community Economic Base Study</u>, C. M. Tiebout, Committee for Economi[c Dev]elopment, Supplementary paper No. 16, New York, 1962.

**For a discussion of these types of inaccuracies, see: <u>Econometric Ana[lysis of Reg]ional Systems</u> by Norman Glickman (Academic Press, 1977), pp. 15-17.

The following studies are written in lay language and provide conside[rable det]ail on doing an export base study, defining sources of data, and using product:

Making Sense Out of Dollars: Economic Analysis for Local Government. Chapter 1, by Eva C. Galambos and Arthur F. Schreiber (1978). Availa[ble] from:

National Lesgue of Cities
1620 Eye Street, NW.
Washington, D.C. 20006

The Community Economic Base Study, by Charles M. Tiebout, New York: Committee for Economic Development, Supplementary Paper No. 16, New Y[ork] 1962.

Socioeconomic Impacts of Western Energy Resource Development. Vol. I (Drsft January 1979). Available from:

Denver Research Institute
Industrial Economic Division
University of Denver
Denver, Colorado 80210
(Contact: Diane Hammond, 302/753-3671)

B. Input-Output Models: A General Description. Input-output analys[is ...]ed on the interrelationships of firms both as purchasers of inputs and [pro]ducers of outputs. This approach allows for the tracing of multiplier [eff]ects associated with new industry development in a more detailed manne[r than] export base multipliers.

The interrelationships among industries in the I-O framework is expre[ssed in] terms of a matrix, called a transactions table, which indicates dollar [flows from] producing sectors to consuming sectors for both interindustry and fi[nal demand]. In figure 5, an illustrated example of a transactions table is provi[ded.]

o Quadrant I (final demsnd) contains all exogenous* sectors of the m[odel] and is made up of household expenditures, exports, capital expendi[tures ...]

[*Ex]ogenous variables are thoae elements in the model that must be specifie[d ind]ependently. Endogenous varisbles are those elements in the model whose [values are] determined by the model, i.e., the dependent variables.

		Agricult Mining Manufact Trade Services Finance	Househol consum	Governme expend	Gross do capita format	
		Quadrant II Intermediate production and consumption	Quadrant I Final outputs of producing sectors			
Agriculture	1	$x_{11} \cdots x_{1j} \cdots x_{1n}$	C_1	G_1	I_1	E_1
Mining	.	. .	.	.	.	.
Manufacturing	.	. .	.	.	.	.
Trade	i	$x_{i1} \cdots x_{ij} \cdots x_{in}$	C_i	G_i	I_i	E_i
Services	.	.	.	.	.	.
Finance	n	$x_{n1} \cdots x_{nj} \cdots x_{nn}$	C_n	G_n	I_n	
		Quadrant III Primary inputs to production	Quadrant IV Primary inputs to final demand			
Payments to						
Households		$H_1 \cdots H_j \cdots H_n$	H_C	H_G	H_I	H_E
Government		$T_1 \cdots T_j \cdots T_n$	T_C	T_G	T_I	T_E
Depreciation		$D_1 \cdots D_j \cdots T_n$	D_C	D_C	D_I	D_E
mports		$M_1 \cdots M_j \cdots M_n$	M_C	M_G	M_I	M_E
grosa outlays		X_1 X_j X_n	C	C	I	E

'almer, et al. "I-O Concepts" in Regional Development a
.uation, USDA Economics, Statistics and Cooperatives
Agriculture Handbook No. 530, May 1978, p. 24.

represent the value of output purchased from the processing s
change in the level of final demand is the action which deter
multiplier estimation.

- Quadrant II (processing sectors) contains those sectors (or i
producing goods and services for final demand. These are the
sectors of the model. All output of the processing sectors i
sold to final demand or to other processing sectors.

- Quadrant III (payments sectors) accounts for primary and exog
inputs purchased by the processing sectors. It shows purchas
processing sectors for inputs they do not produce. Entries i
III include payments to households in the form of wages, sala
rental income, interest income, and profits; payments to gove
imports of goods and services; inventory depletion; and capit
consumption or depreciation.

- Quadrant IV shows the direct transactions between the exogeno
primary input sectors (payments sectors) and the final demand
This includes outputs of the local economy as well as imports
directly into final use without any intermediate processing b
endogenous sectors (for example, services of household employ
labor commuting out of the area for work, intergovernment tra
direct household purchases of nonlocal goods, etc.).

The columns of the transactions represent the producing sectors.
cell element of any column in the table indicates the dollar amount o
a consuming industry makes from a producing industry. Alternatively,
element of any row in the table indicates the dollar amount of sales
producing industry to a consuming industry.

The transactions table can be expressed by the following system

(1) $X_i = \sum_{j=1}^{n} x_{ij} + Y_i$ where $i, j = 1, 2....n$

n = number of industries in the economy

X_i = total output in industry i

---

*Exogenous variables are those elements in the model that must be spe
independently. Endogenous variables are those elements in the model
is determined by the model, i.e., the dependent variables.

technical coefficients expresses each cell element in the first
transaction table as:

(2) $\frac{x_{ij}}{X_j} = a_{ij} \quad i, j = 1, 2 \ldots n$

where x_{ij} = sales by sector i to sector j

X_j = total purchases (or gross outlays) of sector j.

a_{ij} = technical coefficient, or the proportion of tot
of product j that is accounted for by the cost
i.

The technical coefficients table, usually referred to as th
indicates the interindustry linkages among industries in a give
economy. It can be used as a basis for estimating the total mu
(direct and indirect) of an exogenous change in sales to final
example, suppose that exports from the agriculture sector incre
technical coefficients table tells you how much the agricultura
purchase from other industrial sectors in order to produce that
additional sales to final demand. Let us assume that the agric
must purchase 28 cents of output from itself, 11 cents output f
facturing sector and 17 cents output from the services sector.
first round transactions (i.e., the "direct effects"), because
to sell 28 cents to itself it must again purchase 8 cents more
cents times .28) from itself, 3 cents (28 cents times .11) from
and 4.8 cents (28 cents times .17) from services. Furthermore,
facturing and service sectors to sell to agriculture, they must
inputs from other sectors, as indicated in the technical coeffi
The process continues until, ultimately, the total amount each
required to produce is calculated. This process is the source
multipliers.

Matrix algebra provides a much simpler method to determine
plus indirect requirements resulting from a final demand change
one described above. Equation (1) above can be expressed in te

...) X = ... where X = the vector of total outputs
A = the technical coefficients matrix
Y = the vector of final demand

...quation (4) can be reduced to:

$$(5)\quad (I-A)X = Y \quad \text{where } I = \text{the identity matrix}$$

...o develop a solution, both sides of (5) are multiplied by $(I-A)^{-1}$:

$$(6)\quad (I-A)^{-1}(I-A)X = (I-A)^{-1}Y$$

which reduces to:

$$(7)\quad X = (I-A)^{-1}Y$$

...on (7) is the mechanism through which I-O multiplier effects are ...ined. For example, if an economy's exports change due to some exogenou..., the effect on total output (X) would be given through the $(I-A)^{-1}$ ...e matrix, the matrix of interdependence (i.e., direct and indirect) ...cients. There are three general types of multipliers calculated via ...on (7).

...he first type measures gross output or sales, and is usually referred t... ...inal demand multiplier. This multiplier measures the total output (dir... ...direct) required of the economy to support a \$1 change in final demand ... ...n sector.* It is derived from an I-O model by summing the inter...ence coefficients in columns of the inverse matrix $(I-A)^{-1}$. The sum of ...olumn is the output multiplier for the sector named at the head of the ....

...he second type of multiplier measures the total employment generated by ...hange in final demand for a particular sector. The basic assumption ...ying the employment multipliers is that, for each endogenous sector, a ... relationship exists between employment and output. The most common I-... ...ment multipliers are the Type I and Type II.

...art I, section K(2) for a brief discussion of how the final demand by ... is determined.

yment multiplier.

The direct employment coefficient is obtained for each sector of the by dividing total sector employment by total sector output. The direct and indirect employment effects are estimated for each sector by multiplying the inverse matrix, with households exogenous, by a row vector of direct employment coefficients (which is merely a matrix of ratios of employment to output for each sector in the model), and summing the products for each sector (column) of the inverse matrix. Direct, indirect, and induced employment effects are estimated by multiplying the inverse matrix, with households endogenous, by a vector of direct employment coefficients, and summing the products for each column in the inverse matrix.*

The direct employment coefficient of a sector multiplied by that sector's change in final demand provides an estimate of direct employment effects resulting from the final demand change. This estimate multiplied by that sector's employment multiplier equals total estimated employment changes in the economy due to the given change in final demand.

The third type of multiplier is the income multiplier, which measures the total change in personal income resulting from a $1 change in income in a sector in response to a final demand change. There are Type I and Type II income multipliers, which are similar to Type I and Type II employment multipliers.

Direct income coefficients for each sector are found in the household row of the technical coefficients matrix, where households are endogenous, or in the household row of the payments sector, where households are exogenous.

To compute the direct and indirect income effects of a sector (Type I multiplier), each column entry for that sector in the interdependence coefficients (inverse) matrix is multiplied by the corresponding household row of direct income coefficients vector. This multiplication is carried out

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*Households are "endogenous" when they are treated as another industry in the model (i.e., they appear in Quadrant II of the transactions table). Households are "exogenous" when they are treated as primary inputs (i.e., payments) and appear in Quadrant III.

eholds endogenous). The household row of the new matrix yields the dir
rect and induced income effects for each column sector.

Although the I-O analysis can provide considerable insight into the
cture and interaction among sectors of an economy, the approach has sev
tations. First, the assumption of constant production coefficients (i.
s) implies that a doubling of inputs will lead to a doubling of output.
r this assumption, economies of scale are effectively ruled out. Innov
changes in production techniques are also unaccounted for. This omissi
be particularly important for newer industries, such as solar energy or
ervation that are expected to automate and innovate significantly as th
re. The seriousness of the problem will vary with the length of the
cast period.

The assumption of constant coefficients is also inaccurate in cases
e localization and urbanization economies develop. The former arise
many plants in the same industry locate in close proximity to each oth
rnal economies accrue to individual firms since many ancillary firms wi
locate around such an agglomeration and provide specialized services a
r costs. Urbanization economies occur when firms in different industri
te in close proximity to each other and a corresponding infrastructure
t to service them.

Similar limitations apply to the use of direct employment coefficients
e coefficients are based on the assumption of relatively full utilizati
ently employed labor. If a sector was known to have significant under-
oyment at the time of the development of the basic model, use of the di
oyment coefficients is likely to overatate the direct employment effect
eased output. In such instances, the direct coefficients should be ad
eflect the changes in labor productivity that occur when labor becomes
oyed.*

Although this conceptual limitation is significant, it is not insurmou
methods can be used to adjust the input-output coefficients to take ac
echnological and productiviety changes. The first involves adjusting

---

: The Use of Input-Output Analysis, op. cit., page 52.

Methods for correcting these and other estimation errors in I-O
re described in:

Net Energy Analysis: Handbook for Combining Process and In
Analysis. Clark Bullard, Peter Penner and David Pilati, Ce
Advanced Computation, University of Illinois, Urbana, Illin
1976), CAC Doc. No. 214. Price: $5.

The static I-O analysis also assumes that both supply and demand
ompletely elastic. This implies that additional inputs are forthcom
t a constant price and that any quantity of product can be sold with
ffect on price. Although there are some methods available to estima
otential output of a resource constrained sector,** it is very diffi
ncorporate dynamic aspects into traditional I-O analyses.

eferences:

hree reports, available free of charge, provide a step-by-step descr
f the I-O methodology and its application:

The Use of Input-Output Analysis. Regional Development and Plan
U.S. Department of Agriculture, Economics, Statistics and Cooper
Service. Agriculture Handbook No. 530.

Input-Output Analysis Applied to Rural Resource Development Plan
Clifford D. Jones, Jr. U.S. Department of Agriculture, Economic
Statistics and Cooperative Service. ESCS-14.

National Income and Product, Input-Output, and Employment Analys
E. Kutscher. Office of Economic Growth, Bureau of Labor Statist
Department of Commerce.

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ee: The American Economy to 1985, C. Almon, Jr., New York: Harper
66; and Bureau of Reclamation Economic Assessment Model: Technical
S. Department of Interior, January 1978, p. 23.

See: The Use of Input-Output Analysis, Regional Development and Pl
aluation, U.S. Department of Agriculture, Agriculture Handbook No.
-62.

these were then converted to employment. See:

Fiscal Impact of a New Industry in a Rural Area: A Coal Gasificat
Plant in Western North Dakota, in: Regional Science Perspectives,
1976 (published by the Mid-Continent Regional Science Association)
Reprints are available, free of charge, from the Department of Agr
Economics, North Dakota State University, Fargo, North Dakota 5810

etailed bibliography on I-O analysis is presented in appendix D.

The following section provides a list of export base and I-O model
t can be used to determine indirect/induced employment and earnings
erences and costs of this type of information is presented. Those m
t have already been described in the previous section will be referr
y briefly here.

C. Export Base Models. There are two easily accessible export ba
els that can be used to determine the "non-basic" employment and ear
ociated with energy development. These are the Argonne SEAM model (
efly in part 1) and the Bureau of Reclamation Economic Assessment Mo
EAM).

(1). SEAM. The SEAM model determines a simple ratio, complex rat
a ratio computed by regression analysis for the counties studied.
ression coefficient multipliers were derived from the following esti
ation:

$$S = \underline{M} + B_1AM + B_2FC + B_3T$$

where S = number employed in service (or "non-basic" industries)
AM = combined number working in agriculture or mining
FC = manufacturing and construction employment
T = transportation employment

In addition, the equation includes control variables (e.g., number
ilies below poverty, average family income, etc.) when significant.
uld be reminded that the regression coefficient multipliers B_1, B_2 a
must be increased by 1 to be comparable to the ratio multipliers.

The product of the chosen Argonne employment multiplier and the ch
struction or operation jobs associated with an energy project in a g
lds the total employment effects. In addition, the Argonne model pr

year 1, 71 percent; year 2, 17 percent; year 3, 8 percent; year 4, 4

The Argonne multipliers and lag factors are presented and descr in:

A Framework for Projecting Employment and Population Changes Ac Energy Development: Phase 1. Erik J. Stenehjem and James G. M Argonne National Laboratories, August 1976.
Cost: $0.

For an excellent, well-written description of how to use SEAM multip assess the economic effects of nuclear powerplant construction in a region, see:

An Economic Impact Analysis of Energy Facilities with Particula to the Hartsville, Tennessee Area (Preliminary Report) by Walte Thomas A. Reiner and Roger Van Zele, Oak Ridge National Laborat Ridge, Tennessee ORNL/TM-6627 (May 1979).

Available from NITS, U.S. Department of Commerce, 5825 Port Roy Springfield, Virginia 22161. Price: Printed copy $4.50; micro $3.00.

An official procedure for public use of SEAM has not yet been establ Direct all requests to Erik Stenehjem, Roger Shull or Ron Matheny (s section K(1a) for their addresses and phone numbers).

(2). BREAM. The BREAM model can be used to determine the tota and income effects associated with a new energy facility on the coun Unlike the SEAM model, however, the user must specify the direct (or employment associated with the energy facility; BREAM then estimates secondary effects, using export base theory. The model is organized submodels:

- Demographic Submodel, a cohort-survival model which ar effects of natality, mortality and migration on all ma ulations of the local area to make county specific pop projections;

- Economic Submodel, an export-base model which determin employment and total personal income associated with t economic activity. First, basic labor income is deriv

sum of basic labor income, non-basic labor income, and non-labo
income (i.e., including transfer payments, dividends, interest,
rent, and excluding social security payments). Non-labor incom
is partly endogenous, and partly determined outside the model.

- o <u>Labor Market Submodel</u>, which evaluates the consistency of the output from the demographic submodel with that from the economi submodel; i.e., is the number of jobs roughly equal to the numb of persons willing and able to assume jobs. If there is an exce of jobs relative to the size of the labor force, it is assumed that balance will be reestablished between the supply and deman for labor by immigration. If, on the other hand, there is exce supply of labor, it is assumed that outmigration will occur. Whenever migration occurs, it is necessary to iterate back thro the demographic submodel so that the county population can be appropriately adjusted.**

- o <u>Community Allocation Submodel</u>, which allocates the population determined in the demographic submodel to communities within ea county.

BREAM approach has a major advantage over SEAM and other traditional se models: it adds an income sector to the estimation process that sic jobs according to earnings per employee differentials. In this analysis can differentiate among energy facilities with different wa es.

---

omic submodel includes the follow1g BEA industry sectors: farm ors, laborers), mining, contract construction, manufacturing, trans- /communication/public utilities, wholesale and retail trade, finance /real estate, services, government and other (non-farm proprietors).

el also includes a construction worker submodel. This submodel s local/non-local mix of construction workers, estimates the demogra istics of immigrating workers and their families, and allocates them es within the county.

- For the Demographic Submodel:

  --Total births by county by year;
  --Total population by community for 1970 and first forec
    period;
  --Death or survival rates by age and sex;
  --Fertility rates by age of mother;
  --Educational outmigration rates by age and sex by count
  --Nonresident college population by county;
  --Age distribution for retirement by county;
  --Retirement migration.

- Construction Worker Submodel:

  --Project employment by year;
  --Proportion of nonlocal construction married but withou
    families;
  --Average number of nonlocal construction workers per ho
    unit;
  --Indirect purchases of locally produced goods or servic

- Labor Market Submodel:

  --Total labor force by county;
  --Total employment by county;
  --Labor force participation rates by age and sex and by

- Community Allocation Model:

  --Average number of persons per household by county;
  --Average household size for person 60 years of age and
  --Change in average household aize;
  --Project to community distances.

The estimated time for collecting this data initially is ab hours. The work can be done by graduate students (@ $6/hr.), fo about $480-$600. This process will become shorter and less cost becomes internalized in the model over the next year.

odel has not yet been established. All requests should be directed to

Randy Threadgill
Bureau of Reclamation
Denver Federal Center
Denver, Colorado
303/234-3166

The BREAM approach is also available in a model developed by the S
rizona.** The Arizona Economic Demographic Projection Model (EDPM) ma
mployment and income projections to 2000 for all counties in Arizona.
f running the model is $50-$75 per run (staff and computer time). The
un for Arizona is already on file. The model could be purchased and a
ther states. However, because of the limited documentation of EDPM, p
sers are advised to use BREAM for regions other than Arizona. Contact

Bryan Meincke
Department of Economic Security
Office of Planning (0452)
P.O. Box 6123
Phoenix, Arizona 85007

eferences (free of charge):

Bureau of Reclamation Economic Assessment Model (BREAM) Technical Description. Bureau of Reclamation, Engineering and Research Cent Denver, Colorado 80225. Prepared by: Mountain West Research, Inc Temple, Arizona. January 1978.

Economic/Demographic Assessment Manual. Bureau of Reclamation. Engineering and Research Center, Denver Federal Center, Denver, Co 80225. Attention: 922.

The Arizona Economic Demographic Projection Model (EDPM). E. J. A T. L. Beckhelm and W. M. Hannigan. Office of Economic Planning an Development, Phoenix, Arizona (1977).

Submodels cannot be run separately.

**EDPM was, in fact, the forerunner of BREAM.

relies heavily on data input by the user which, in this case, is pr
Utah-specific. Hence, UPED is not readily adaptable for projection
than in Utah. For more information, contact the Office of the State
Coordinator (Salt Lake City, Utah).

D. Input-Output Models. Several I-O models are available for determining the indirect/induced employment and earnings effects as energy development. These are:

(1). The Bureau of Labor Statistics Input-Output Model (BLS/I-(described in part 1 of this section, can be used to determine total earnings and output associated with alternative energy scenarios.

Availability and Cost of Information:

- Input-Output Matrix. Data from 129 industries for 1976, 19 1990 (projected) include: Input-output coefficient matrice final demand and components; civilian employment; and wage employment and output series by industry with additional an 1958-74. Cost: $100.*

For users without access to computer facilities, the Office of Econ has done some contract work to run the BLS model and provide analys output. The cost depends on the task. For further information, co

Charles Bowman/Ken Rogers (202/523-9036)
Office of Economic Growth
Bureau of Labor Statistics
U.S. Department of Labor
Washington, D.C. 20212

References (with Applications to Energy/Employment issues):

An Analysis of the Macroeconomic Effects of Industrial Cogener Development Using Input/Output Techniques and the DRI Quarterl Macroeconomic Model. September 1978. JRB Associates, Inc., 8 Drive, McLean, Virginia 22102. Contact:

*Note: This is the same tape used for obtaining employment and ear ratios. See part 1, section K(2d).

ashington, D.C.
)2/376-4827

: Employment Analysis of Alternative Energy Scenarios. U.S.
:ment of Energy. Energy Information Administration (August 1978).
act: Ron Earley 202/633-2693.)

economic and Sector Implication of Installing 2.2 Million Residential
Units (Draft) Energy Information Administration (December 1978).
:t: Ron Earley.

The Brookhaven I-O/BESOM system can be used to evaluate the direct
ary employment effects of alternate energy scenarios on a national
: system can be segmented into three separate models: (1) BESOM is a
gramming model of the energy sector; (2) the BNL I-O model is a 110
model* of the national economy; and (3) the linked BNL/BESOM model,
.nes energy and nonenergy sectors to evaluate alternative scenarios.
ese models is described briefly below.

- BESOM can determine the minimum cost allocation of energy supplies to meet energy demands. BESOM can also be used to determine some of the cost and economic impacts of specific demand/supply configurations. The user specifies a set of energy requirements defined by end-uses, a set of available energy resources and conversion technologies and costs. The eight end-product energy sectors in the model include:

ore reduction feedstock	process heat
chemical feedstocks	water heat
motive power	space heat
air conditioning	electric power

The 12 energy supply/conversion sectors in the BESOM model currently include:

coal	refined oil products
crude oil and gas	pipeline gas
shale oil	coal combined-cycle electric
methane from coal	

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*, section K(2a).

sectors, see attachment to table C-4, in appendix C.

- o <u>BNL I-O</u> model has 110 sectors with "A" matrix coefficients and final demand, total output, employment and earnings vectors forecasted for 1985. Several distinguishing characteristics of the BNL I-O model differentiate it from conventional interindust I-O models:

  --The BNL model is composed of energy and nonenergy sectors with the output of the energy sectors expressed in terms of physica Btu units (the nonenergy sector is expressed in constant dolla

  --Outputs of the energy supply/conversion sectors are distribute to energy product sectors instead of directly to consuming sectors. The supply sectors convert and distribute raw fuels sectors producing traditional energy forms. The outputs of these supply/ conversion sectors are then distributed to energ end-product sectors. (See table C-4 and attachment.)

he "A" matrix for the BNL I-O model has the following form:

$$
\begin{array}{llc}
 & & \begin{array}{ccc} \underline{S} & \underline{P} & \underline{I} \end{array} \\
\text{Energy Supply/Conversion} & S & \\
\text{Energy Products} & P & \left[\begin{array}{ccc} A_{SS} & A_{SP} & 0 \\ A_{PS} & 0 & A_{PI} \\ A_{IS} & 0 & A_{II} \end{array}\right] \\
\text{Nonenergy Sectors} & I &
\end{array}
$$

here:

A_{SS} = input-output coefficients describing sales of the output of one energy/supply conversion sector to another energy conversi sector and conversion losses incurred in producing or distributing energy.

producing sectors; energy products are used by the nonenergy producing sectors.

A_{PS} = input-output coefficients describing how energy products--fi energy forms--are used by the energy-supplying industries. Included here would be electricity use for lighting a refine

A_{PP} = 0 implying that energy products are not used to produce ener products.

A_{PI} = input-output coefficients describing how energy products--fi energy forms--are used by nonenergy-producing sectors. This submatrix describes the ways end-use energy forms are used in the nonenergy-producing sectors. Examples are blast furn heating or space heating.

A_{IS} = input-output coefficients describing the uses of nonenergy materials and services by the energy industry such as pipes pumps.

A_{IP} = 0 implying energy product-sectors equipment require no material or service inputs. This is because they are pseudo sectors and not real producing sectors.

A_{II} = input-output coefficients describing how nonenergy products are used in the nonenergy-producing sector. An example woul steel for golf clubs.

tructure, which allows the specification of transactions in terms of f d-use, has certain important advantages:

- Conservation owing to technical improvements or reductions in consum demand may be implemented by modifying the A_{PI} coefficients or final demands for energy products. This is more direct and realistic than modeling reductions in the demand for energy products by reducing th sales of several primary or secondary energy sectors as would be req in a conventional input-output model.

o The BNL/BESOM linked models provide for the endogenous esti A_{SS}, A_{SP}, derived from the BESOM solution output. Likewise linked version allowa interindustry demands for energy prod those variables that are required for GNP determination mus specified exogenously. These variables (personal consumpti ment, etc.) can be determined by linking the BNL/BESOM mode Long-Term Interindustry model or the Hudson-Jorgenson Long- Interindustry Transactions model (H-J).*

Brookhaven National Laboratories is in the process of incorpor the SERI data base for 16 solar technologies in the BNL/BESOM syste part 1, section G). This work will be completed by late summer 197

Cost and Availability of Information:

As in the case of the BLS I-O model, data tapes for the BNL I-O/BES readily available to the user with computer facilities. Brookhaven arrangements for users outside of the Federal Government to buy com off BNL computers. However, it is virtually impossible for a non-F Government user to purchase staff/analyst time from the National La The fee structure for data tapea and computer time are:**

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*For a description of these long-term models and their applications Estimation of the Short-Term Mscroeconomic Impacts of Energy Price the U.S. Economy, (appendix A), JRB Associates, Inc., McLean, Virgi 1978); A Comparative Assessment of Energy-Economy Interactions: Pr Growth, (DRAFT: January 1979) Richard Goettle, Edward Hudson, Joan Brookhsven National Laboratory; and Energy Conservation Policies, I Mechanisms, and Impacts, (December 1978), Edward Hudson and David F Brookhaven National Laboratory.

**See part 1, section K(2a) for the free information available on e employment and occupational mix from the BNL model.

ESOM	free	$200
NL I-O	free	$100
ESOM/BNL I-O	free	$300
RI/BNL I-O	free	$200

OTE: The combined BNL I-O and Hudson-Jorgenson (H-J) macroeconomic
ot available through Brookhaven to outside users since the H-J mode
roprietary.

eferences:

Documentation of the Brookhaven Energy I-O and I-O/BESOM Linkag
Fraser. Brookhaven National Laboratory (August 1978).

Brookhaven Energy System Optimization Model Methodology and Doc
(Version 2.1). Cherniavsky, Juang, Kydes and Rabinowitz. Broo
National Laboratory (February 1978).

Applications of the model to energy issues:

An Energy and Economic Evaluation of Policies for Accelerated I
Efficient Automobiles. Walter Brooks, Steven Carhart, Gordon M
Shirish S. Mulherkar. Brookhaven National Laboratory (August 1
Preliminary Report.

Energy Employment, and Environmental Impacts of Accelerated Inv
in Conservation and Solar Technologies in Buildings. Steven Ca
Shirish Mulherkar, Jay Schwam. Brookhaven National Laboratory
1978). Preliminary Report.

A Comparative Assessment of Energy-Economy Interactions: Price
Growth. Richard Goettle, Edward Hudson, Joan Lukachinski. Bro
National Laboratory (January 1979). Draft.

ersonal Contacts:

Dick Goettle
Dale Jorgenson Associates
Department of Economics
Harvard University
122 Littauer Center
Cambridge, Massachusetts 02138

(subsequently revised) from data obtained by personal int[...]
The model cost approximately $250,000 to develop. Descri[...]
the methodology (including sample interviews) and potenti[...]
applications is available in:

> Stimulating Regional Economic Development. William [...]
> Miernyk *et al*. (Heath, Lexington Books, 1970).

The model includes sectors for two types of coal mining (underground; strip and augur), for petroleum and natural [...] for electric and gas power systems. The model is on comp[...] available for less than approximately $100. Contact:

> James Maddy
> Governors Office of Economic
> and Community Development
> R151 State Capitol
> Charleston, West Virginia 25305

o Georgia. The Department of Industry and Trade financed t[...] development of a survey-based (for manufacturing sectors) [...] I-O. The 1970 model is available for 367-sector, 50-sect[...] 30-sector aggregations corresponding to the national BEA [...] model. The model cost about $80,000 to develop in 1971. Description of the model and applications is available in[...]

> Using the Georgia Economic Model. William Schaffer, [...]
> Laurent, Ernest Sutter, Jr., Office of Planning and [...]
> State of Georgia. 1972.

The model includes individual sectors for petroleum produ[...] and utilities. It is available for use for less than $1,[...] Contact:

> Dr. William A. Schaffer
> College of Industrial Management
> Georgia Tech
> Atlanta, Georgia 30332
> 404/894-2600

which enables it to be used for projections to 1985 and 19[illegible] model cost approximately $200,000 to develop ($125,000 for [illegible] model; $75,000 for the econometric "linkage"). A descript[illegible] the model and its potential applications is available in:

> <u>The 1972 Washington Input-Output Study</u>, by Phillip J. Bourque and Edward J. Chambers, Seattle, Washington: The Graduate School of Business Administration, Unive[illegible] Washington. June 1977.

> <u>The Washington Projection and Simulation Model</u>. Phil[illegible] Bourque and Edward J. Chambers, University of Washing[illegible] September 1977.

> <u>The Input-Output Structure of Washington State</u>, Philli[illegible] Bourque, Richard S. Conway, Jr., University of Washin[illegible] February 1976.

The model includes sectors for petroleum refining, natural gas, electricity and mining. The cost of using the model [illegible] on the task. Contact:

> Phillip J. Bourque
> Graduate School of Business Administration
> University of Washington
> Seattle, Washington
> 206/543-4484

An inventory of regional and state input-output models and documenta[illegible] available in:

> <u>Regional and Interregional Input-Output Analysis: An Annotate[illegible] Bibliography</u>, by Frank Giarratani, James D. Maddy and Charles Socher, West Virginia University Library. 1976.

> <u>An Inventory of Regional Input-Output Studies in the United St[illegible]</u> Occasional Paper No. 22 by Phillip J. Bourque and Millicent C[illegible] Graduate School of Business Administration, University of Was[illegible] Seattle, Washington. 1970.

Non-survey models adapt survey-based national or regional models to economy through the use of secondary data sources (e.g., U.S. Census employment departments).* Any primary data that the researcher can low cost is also used in this estimation.

On balance, the non-survey approach to estimating regional I-O represents a relatively cost-effective means for performing regional It is no doubt less accurate than survey-based methods, but it is us less expensive to develop. Non-survey models are more accurate when evaluate exogenously generated impacts than for "structural" changes "forecasts". But, in any case, diminishing returns set in rapidly i data collection for the construction of an I-O model for a particula Three non-survey regional I-O models are described in this report: Industrial Multiplier System (RIMS)**, the Regional Science Research Model (RSRI) and the Lawrence Berkeley Laboratory Model (LBL). The described in a later section due to the relatively high costs involv development and use. The RSRI and RIMS models are described below.

(4a). The Regional Science Research Institute Model (RSRI) pro detailed estimates of regional impacts which result from the direct stimulus provided by, for example, construction and operation of a n or in the contraction of such an activity. The specific impacts tha estimated are:

- o Economic activity, by industry;
- o Wage and salary income, by industry;
- o Employment, by industry;
- o Employment, by occupation;

---

*See, for example: The Use of Input-Output Analysis, Appendix B, U.S. Department of Agriculture, Economics, Statistics and Cooperativ Service, Agriculture Handbook No. 530.

**See also part 1, section K(2b).

Emissions to water, by industry and type of emission.

el specifies 490 industry sectors (including separate sectors for steam engine manufacturing, electric companies and systems, gas es and systems, crude petroleum and gas) and 232 occupational catego ble C-8 in appendix C). The model can be adapted to any state, metr area, or other grouping of contiguous counties, and can be modified estimates for the subregions which constitute a region as well as f ion as a whole. A typical adaptstion costs in the neighborhood of , but it could be significantly more depending on data problems, the n of subregional models, the addition of submodels for energy use, s eneration, emissions to air, emissions to water, extra help in setti el up on a client's system, etc.

RI has adapted their model to several substate regions, including ladelphia SMSA, the Richmond, Virginia Planning District, the Baltim d the New York-New Jersey metropolitan region. Once the model is ac ts to RSRI of maintaining and running it are relatively low. A typi e of the prices charged by RSRI for simple analyses using an already ed regional model is presented below:

RSRI Billing Fees for Stsndard*
Regional Input-Output Runs Done at One Time

Number of Runs	Totsl Fee
1	$ 500
2	700
3	900
4	1,050
5	1,200
6	1,350

sddition to this detailed, regional I-O effort, RSRI has also devel fied I-O model which is linked to an econometric description of bas

*bance to final demand expressed as outputs of one or more four-digit (1967 SIC definition).

Virginia 22161) for under $100.*

Additionsl information on the RSRI Regional Models can be obta

Dr. Benjamin H. Stevens
President
Regional Science Research Institute
Wentworth Building
256 North Pleasant Street
Amherst, Masaachusetts 01002
(Telephone: 413/256-8526)

Dr. Robert E. Coughlin
Vice President
Regional Science Research Institute
P.O. Box 8776
Philadelphia, Pennaylvania 19101
(Telephone: 215/222-3940)

References:

Richmond Input-Output Study: Volume II, Construction of the M
by Gene Steiker et al. RSRI, P.O. Box 8776, Philadelphia, Pen
19101 (August 1976).

Regional Economic Impact from Construction of a Nuclear Electr
Plsnt, by Gene Steikcr and James Strathman. RSRI Discussion P
No. 91 (December 1976). This paper uaes the Philadelphia SMSA

The Employment Sector of a Regional Policy Simulation Model, b
Treyz et al. RSRI Discussion Paper Series: No. 107 (November

*The "core" program described here is modeled after the Massachuset
Policy Analysis Model (MEPA), which includes the relationships that
models and also allows for substitution smong factora of productior
relative factor costs. MEPA coat $200,000-$300,000 to develop. To
arrangements for its use have been limited to atate agencies and th
(for a subacriber fee of about $5,000). For more information on ME
applications, contact: George Treyz, Economic Department, Universi
Massachusetts, Amherst, MA. (413) 545-0915/2590.

Cooperative Highway Research Program (National Academy of Sciences and
Regional Science Research Institute) Preliminary Report (March 1979).

(4b). The Regional Industrial Multiplier Systems (RIMS), as described
1, section K(2b), can be used to determine the direct and secondary em
output and earnings effects of energy choices on a regional level.

ability and Cost of Information:

o Multipliers for selected areas are available without charge from tw
sets. One set is estimated by BEA economic area (see figure 3 in
section I) for 56 industries aggregated from the basic 484 national
model industries. A second set is estimated, by state, for a 103-
industry aggregation.

Contact: Joseph Cartwright (202/523-0594)
Regional Economic Analysis Division
Bureau of Economic Analysis, BE-61
Department of Commerce
Washington, D.C. 20230

o Industry-specific multipliers are available from BEA for any region
composed of one or more counties and for any of 484 industries. Re
are reported in tabular form similar to the example in exhibit 2.
Factors for converting a gross-output change to a change in earning
and employment are also provided.*

Cost: $1,000 for each region. The user need only define the regio
terms of counties.

Contact: Joseph Cartwright (see above)

o Specifically tailored quick-response packages can also be developed
through BEA contract arrangements, that will address analytical nee
not covered by the standard output of the system.

---

her option available to the user (at additional cost) is the aggregati
e sectors in the national I-O model.

Energy Information Administration
National Energy Information Center
Office of Energy Information Services
Attention: Heidi Sanford (202/634-5610)
Room 230
1726 M Street, NW.
Washington, D.C. 10461

The data is available on 8 files:

File 1: Census-Region Multipliers and Components. This f
16 sector industrial output multipliers and compo
census regions.

File 2: Multi-Region Multipliers and Components. This fi
103 sector industrial output multipliers and comp
each state and census region.

File 3: Census Region Direct Coefficients. This file con
direct coefficient estimates for 16 sectors in ea
region.

File 4: Multi-Region Direct Coefficients. This file cont
direct coefficients for 103 sectors in each state
census region.

File 5&6: Industry Earnings--Gross Output Ratios. This fil
industry earnings--gross ouput ratios for states
regions (in 1967 dollars).

File 7: Industry Employment-Earnings Ratios. This file c
industry employment-earnings ratios in the form o
estimates (weighted averages in 1967 dollars).

File 8: Inverse Matrices. This file contains the inverse
(103 sector) for states and consus regions.

System Name: Preliminary READ Model Data Base.

EGIONAL INDUSTRIAL MULTIPLIER SYSTEM, MILTON, PA. 2024 ICE CREAM + FROZEN DESSERT

		Elements of		
IC	Industry Name	Direct Component	Indirect-Induced Component	Total Multiplie
1	Farms	.0934	.0941	.1875
7	Agricultural services	.0000	.0092	.0092
1	Coal mining	.0000	.0006	.0008
4	Nonmetallic mineral mining and quarrying	.0000	.0005	.0005
5-17	Contract construction	.0027	.0063	.0090
0	Food and kindred products	.2851	.0618	1.3469
2	Textile mill products	.0000	.0133	.0133
3	Apparel and other fabricated textile products	.0002	.0112	.0114
4	Lumber and wood products, except furniture	.0000	.0035	.0035
5	Furniture and fixtures	.0000	.0008	.0008
6	Paper and allied products	.0536	.0064	.0600
7	Printing, publishing and allied products	.0000	.0023	.0023
8	Chemicals and allied products	.0000	.0015	.0015
9	Petroleum and related industries	.0019	.0041	.0060
0	Rubber and miscellaneous plastic products	.0001	.0001	.0002
1	Leather and leather products	.0000	.0053	.0053
2	Stone, clay and glass products	.0000	.0007	.0007
3	Primary metals industries	.0000	.0017	.0017
4	Fabricated metals products	.0003	.0046	.0049
5	Machinery, except electrical	.0000	.0002	.0002
6	Electrical machinery	.0000	.0004	.0004
71	Motor vehicles	.0000	.0000	.0000
72-379	Other transportation vehicles	.0000	.0001	.0001

This exhibit includes only some of the industrial sectors in the RIMS multiplier system, nd is for illustrative purposes only.

Vol = SER = FE7985, F10972.

Requests should be made in letter form, and should indicate the type
form of information needed (e.g., data tapes or computer printout).

Costs: for tapes: cost of blank tape for all files listed above (a
$50);for computer printouts: minimal (about $10 to $25)

Bureau of Economic Analysis (BEA), in conjunction with the U.S.
nt of Housing and Urban Development (HUD) has recently developed RIM
ers for 46 construction induatries in 61 SMSA economic areas. For 2
SA areas, BEA also disaggregated the multipliers into "core county"
-core county" (i.e., suburb) multipliers. BEA has put together a pa
ng the multipliers for the 61 SMSA areas, entitled:

Regional Impact of Changes in Conatruction Spending: An Analysis o
A Multiplier Differentiala (mimeo June 1979) by Joseph Cartwright,
olph Depass, Richard Gustely, and James Younger. Regional Economic
lysis Division, Bureau of Economic Analysis, U.S. Department of Comm

is in the process of developing a similar paper for the "core" and
e" multipliers associated with construction industries in the 20 SMS
For more information on these multipliera, contact:

Richard Guately (202/523-0953)
Room 305
1401 K. Street, NW.
Washington, D.C. 20230

RIMS multipliera are also used as input into a local impact assess
veloped by the Energy Systema Research Group, Inc. (ESRG). The ESR
s the following features:

A data base containing information on cost, labor requirements
and energy savings for various residential energy technologies.

A financial package allowing the user to develop implementation
rates for residential energy technologiea under alternate financial
assumptions. Data in technologies can come from the ESRG data baae
elsewhere.

currently in progress on a commercial sector data base and a
ompute "public benefits."

prepared to run specific analyses developed by clients and/or to
evelopment of a client's program. For the analysis of a well-
energy program using ESRG data, or a client's data base which is
the cost would run about $6,000. This includes the purchase of one
ultipliers for the region under consideration. For further
contact:

Stutz
gy Systems Research Group, Inc.
Milk Street
on, Massachuaetts 02101
) 426-5844

he <u>INFORUM</u> model, developed at the University of Maryland's
y Economics Research Project, ia a 200-sector national input-output
ed to produce annual projections over a 10 to 15-year time horizon
s the base year). The INFORUM model forecasts the sales of each of
ors:

as material or service inputs in the production of the
200 products;

as materials used in 30 construction activities;

as capital equipment purchases by 90 industries (which
are aggregates of the 200 sectors);

as purchases for six categories of Government operations;

as exports (offset by imports aa a negative entry);

as inventory change;

aa peraonal conaumption expenditure.

el also provides forecasts of prices and wages of the 200 sectors,
nt in the 90 aggregate sectors. INFORUM has alao been used to

Table C-9 in appendix C lists the 200 sectors in the INFORUM mode
heir corresponding SIC codes. Note that the model includes separate
or coal mining, crude petroleum, natural gas, petroleum refining, fue
lectric utilities.

vailability and Cost of Information:

he INFORUM model is available for use only to subscribers.

Cost of annual subscription: $5,000.

Contact: Margaret Buckler/Clopper Almon
Economics Department
University of Maryland
College Park, Maryland 20742
301/454-5384

eferences:

A Brief Description of INFORUM, Interindustry Forecasting Project
University of Maryland (November 1978).

1985: Interindustry Forecasts of the American Economy, C. Almon,
Buckler, L. M. Horwitz, and T. C. Reimbold. Lexington, Massachus
heath, 1974.

(6). The REAP model, as described in part 1, section K(2c), can
nformation on the direct and secondary employment effects of energy d
n western North Dakota.

vailability and Cost of Information:

- o REAP model run for a single energy expansion scenario: free of charge
- o REAP model run for two energy scenarios: less than $10

See: Employment Impacts of Achieving Federal Energy Conservation Goa
ertaining to Automobile MPG Efficiency, Home Retrofitting and Industr
e for the Period 1978-1985; Douglas C. Dacy, Robert E. Kuenne and Pa
nstitute for Defense Analysis, Arlington, Virginia. IDA Paper, P-134

REAP has been made available to Texas, free of charge, for adap[...]
e state's economy. Adaptation of the REAP model to Texas is expec[...]
quire 3 months of work by professionals in regional economics, 3 m[...]
rk by economic/demographic analysts, and 3 months of work by compu[...]
ogrammers. The estimated cost of this project is $30,500:

Professionals:	5 months @ $25,000/yr. =	$10,500
Economic/demographic analysts:	8 months @ $1,000/mo. =	8,000
Computer programmers:	6 months @ $1,000/mo. =	6,000
Computer time		3,000
Travel and data collection expense		3,000
	Total	$30,500

rsonal Contacts:

Glen D. Schaible
Research Coordinator
Regional Environmental Assessment Program
Suite 521
316 North Fifth Street
Bismarck, North Dakota 58505
(701/224-3700)

r information on the Texas adaptation of REAP:

Larry Leistritz (701/237-7441)
Department of Agricultural Economics
North Dakota State University
Fargo, North Dakota 58105

(7). The Lawrence Berkeley Laboratory (LBL) has developed a na[...]
gional modeling capability to assess the direct and indirect emplo[...]
come effects associated with alternative energy scenarios. LBL ha[...]
e 1967 BEA national I-O table to 1972 and disaggregated the 7 mine[...]

ionalize the national I-O to each state. Regional I-O tables have al
n developed for the eight Rocky Mountain States and California, as de

Development of State Interindustry Models for Rocky Mountain
and California. Jayant Sathaye and Leonard Kunin. Energy An
Program. Lawrence Berkeley Laboratory. LBL-4465. February
Cost $4.50 (microfiche: $3.00), available from:

National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, Viginia 22161

In addition, LBL has the capability to regionalize the Bechtel ESPM e to each state. Figure 6 illustrates the general methodology linkin rgy supply planning models with the input-output models.

ilability and Cost of Information:

The cost of regionalizing the ESPM and I-O models, running the mode lyzing the results for various energy scenarios is approximately $100 s cost is significantly less for those states for which interindustry regionalized ESPM data has already been developed. These include: ifornia, Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah ming.

An example of this type of analysis, performed for the State of Cal LBL, is presented in:

Analysis of the California Energy Industry. Energy and Enviro
Division, Lawrence Berkeley Laboratory. (January 1977).

further information contact:

Jaysnt Sathaye
Lawrence Berkeley Laboratory
University of California
Berkeley, California 94720
415/451-6292

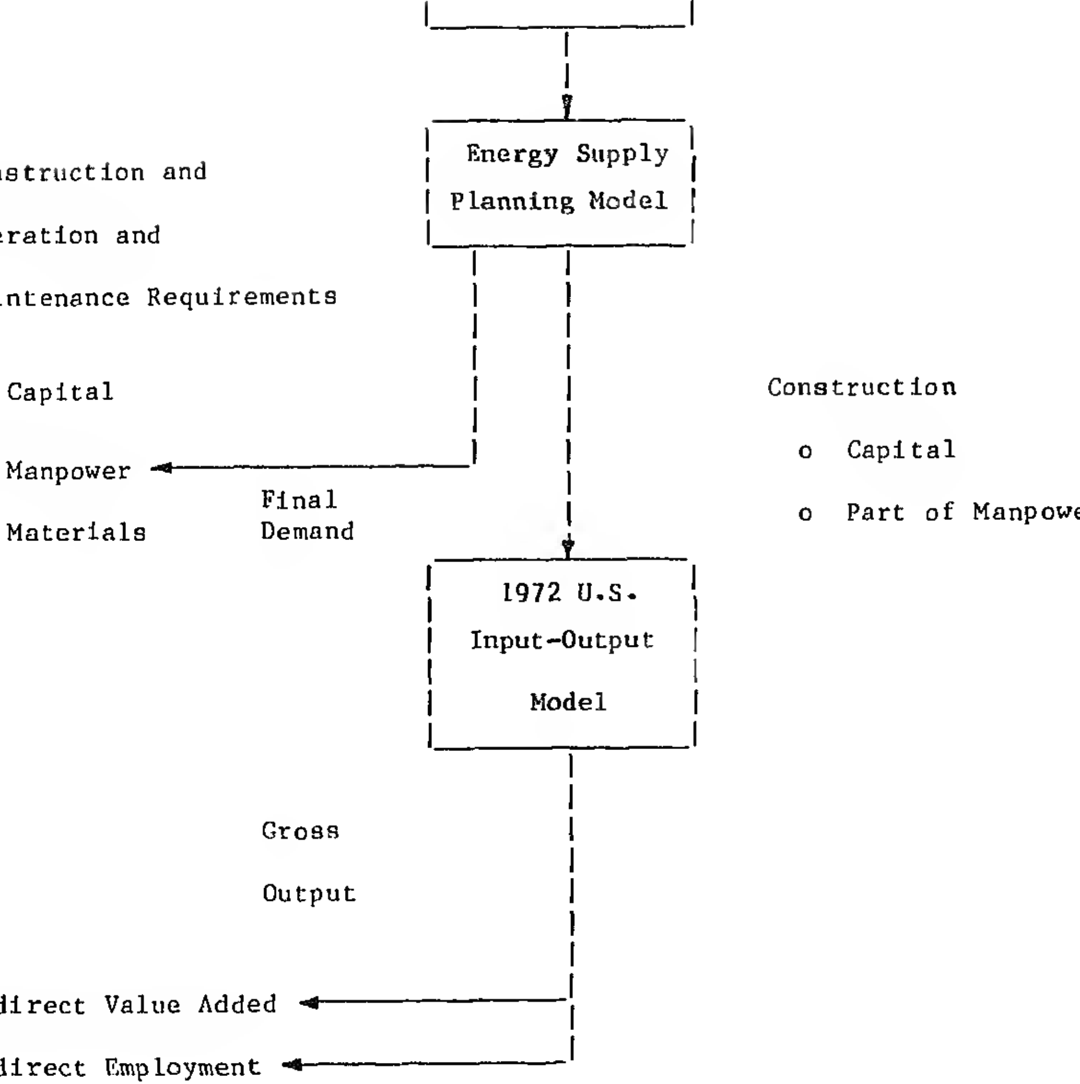

Figure 6: Analytical Methodology for Lawrence Berkeley Laboratory Model

o The policy question requires analysis of the total net emplo[y-]
impact associated with each energy alternative <u>and</u> the job c[r-]
associated with the displaced system is realized in the loca[l]

o The policy question requires a comparative analysis of net e[m-]
impacts among energy alternatives <u>and</u> the alternative have d[...]
total costs <u>or</u> they each displace different energy sources.

The sources for direct and indirect/induced employment effects [...]
2) can be used to determine the coat and availability of information [...]
displacement effecta.

<u>Part 4. Respending/Substitution Effects</u>. In addition to the d[...] indirect/induced and displacement effects, there is another effect t[...] if the energy source encouraged through policy measures incurs diffe[...] costs than the next best alternative. If this energy source is less [...] real economic growth (and hence employment and income growth) occurs [...] resource savings are "respent" on additional goods and services. Co[...] energy source that costs more per energy output than its alternative [...] made available to the public, can decrease overall employment and ea[...] diverting spending from other (more labor intensive) sectors of the [...] The former situation ia referred to as the "respending effect"; the [...] the "substitution effect." The respending/substitution effects will [...] estimation in almost all cases where energy alternatives have unequa[...] The major exception is when energy alternatives are compared for a v[...] undiversified economy, where most of personal consumption expenditur[...] investment are made outside the region (see section I).

In order to estimate the respending/substitution effects associ[...] with energy policies, it is necessary to determine:

(1) The real resource (i.e., unsubsidized) costs of the energy [...] be encouraged and of its competing energy source(s) over t[...] vation period. The difference between these costs represe[...] energy cost savings/increases associated with a particular [...] policy.

(2) Who realizes theae energy cost savings/increases--private [...] consumers or the Government?

financed (i.e., from reductions in consumer expenditures, inve
or increased Government debt)?

(4) What are the employment and earnings effects associated with a
dollar increase/decrease in consumer expenditures, investment
Government debt?

It should be noted that the importance of these considerations will
ffer significantly across regions. For example, if the subsidies to c
onal energy are primarily Federally funded, then individual communitie
t need to factor these subsidies into their energy costs. This is bec
st of Federal subsidies is spread over the entire Nation. Any one com
only negligibly affected. On the other hand, the magnitude of these
ll make a difference to the Nation as a whole, or to large subnational
milarly, any consideration of cost-savings and how they are spent may
relevant to a small region (where most goods and services are imported
rger, well-diversified economies, however, these considerstions will b
portant.

Unfortunately, there are large gapa in information about the real r
sts of energy, the behavior of energy consumers facing changes in ener
sts, and the effect of different types of expenditures on employment a
rnings in the economy. A discussion of some of the relevant sources f
pes of information is presented below.

A. <u>Real resource costs of energy</u>. There is very little informatio
the real resource cost of conventional energy sources, mainly because
at cost is "hidden" by existing pricing policies and a variety of dire
direct subsidies. A recent analysis by the Battelle Pacific Northwest
boratory* indicates that the Federal Government has provided on the or
00 billion in support of conventional energy over the 1918-1977 period
ble 6). While issue may be taken with the exact figure, it is clear t
nventional energy sources have been substantislly subsidized.

Price regulations, however, provide a much larger price advantage t
nventional fuels. Electricity, gas and oil were sold last year substa
ally below their replacement costs, due in part to Federal price contr
l and gas, and in part to state-regulated, average-cost utility rate
ructures. A preliminary analysis by the Department of Energy compares
erage user prices of oil, gas and electricity with their replacement c

---

<u>n Analysis of Federal Incentives Used to Stimulate Energy Production</u>,
ttelle Pacific Northwest Laboratories, March 1978.

Due to the paucity of information in this area, it is virtua for policy analysts to accurately project real resource costs of energy for their area. Hence, the analysis is limited to the use user price projections. In the case of oil and gas, where prices to gradually increase to their replacement costs, this omission i serious. In the case of electricity, however, user prices will b indicator of resource costs in areas where utilities continue to rate structures. Analysts who are trying to quantify the cost di among energy alternatives should always note this discrepancy. A can be made by performing "sensitivity analysis." For example, t can first estimate the positive direct and secondary employment e energy alternative, and then determine how high the energy costs either offset these effects, or make one indifferent between the ment in question and an alternative one. These "implicit" replac then be compared to those in table 7 (after taking account of rea cost escalation) to assess whether they are at all reasonable exp the future.

There are many sources for energy user prices, including loc energy companies, local, state and national energy offices and re tutions (see, for example, a description of the Bechtel and SERI section I, part 1). Useful data is alao available from recent pu including:

- o <u>1977 Annual Report to Congress</u>. Vol. I, II, III, Energy Administration, U.S. Department of Energy DOE/EIA-0036/1, 1978). This report contains historical data and projecti energy use and energy prices by sector. Energy sources i electricity, natural and liquid gas, petroleum products a regional information is also available, although detailed

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*The Domestic Policy Review of Solar, <u>A Response Memorandum to th</u> December 1978. Available from: U.S. Department of Energy, Advar Systems Policy Division.

**It should be noted that these comparisons do not capture the wi regional variability. For example, current gas prices range from San Francisco-Oakland to $4.05/mmBtu in New York. In all-electri heating rates range from $3.25/mmBtu in Seattle (the next lowest Chicago) to $17.80/mmBtu in New York.

TABLE 6. An Estimate of the Cost Incentives Used to Stimulate Energy Production (in Billions of 1977 Dollars)

	Nuclear	Hydro	Coal	Oil	Gas	Electricity	Total	Percen… Total I…
		1.8	4.03	50.4	16.04	31.37	103.64	4…
…nents				1.1			1.10	
…ents	1.1	0.03	0.67	41.9	0.06		43.76	2…
…nal Services			2.31	6.0		0.48	8.79	
…itional …es	15.1		2.68	1.5	0.3		19.58	…
…ctivity	1.8	13.5(a)	0.02	0.4	0.1	24.73(a)	40.55	1…
	18.0	15.33	9.71	101.3	16.50	56.58	217.42	1…
…of Total …ives	8.3	7.0	4.5	46.6	7.6	26.9	100.0	

…ue based on incentive definition 1 (Federal money outstanding).

	($ /mmBtu)	($ /mmBtu)	($ /m
Natural Gas[a]			
Residential	2.80	2.56	0
Commercial	2.80	2.28	0
Industrial	2.80	1.87	0
Utility	2.80	1.60	1
Electricity[b]			
Residential	10.21	9.59	0
Commercial	10.21	9.50	0
Petroleum Products[c]			
National Average	2.80	2.33	0

[a]Replacement cost represents the delivered price of industrial disti at current world oil prices. Average prices represent 1977 user pri to 1978 dollars.

[b]Replacement cost represents in-service costs for a new baseload coa powerplant using bituminous coal, scrubbers at 85 percent removal ca This cost includes all of transmission costs and 25 percent of distr costs. Baseload costs were used because in 1977, solar generally co baseload generation. Coal was used here because it represents the m type of baseload plant, thus, providing an upper-bound estimate.

Average electricity prices for 1977 were adjusted to 1978 dollars. 75 percent of the average distribution coat was deducted from averag This adjustment was made because potential solar users will already to the grid for lighting and other uses of electricity. Hence, the additional electricity will generally include only a fraction of dis costs.

[c]Replacement costs represent the average landed price of imports in (1978) dollars, converted into mmbtu at 5.8 mmBtu/bbl. Average pric refinery acquisition costs.

Source: The Domestic Policy Review of Solar, A Response Memorandum President, December 1978. Available from: U.S. Department Advanced Energy Systems Policy Division.

. Applications of Solar Technology to Todays Needs. Vol. 1 and 2. Office of Technology Assessment, U.S. Congress, Washington, D.C., September 1978. This is an excellent source of information on so applications and includes cost projections for solar and conventi energy in four sample cities: Albuquerque, New Mexico; Boston, Massachusetts; Fort Worth, Texas; and Omaha, Nebraska. Available the Superintendent of Documents, U.S. Government Printing Office, Nos. 052-003-00539-5 and 052-003-00608-1.

. New England Blueprint for Energy Action. (March 1979) By the New England Energy Congress, presents projections of energy costs (to consumer) to the year 2000 for New England. The energy sources i solar, gasoline, natural gas, heating oil, wood and residuals, co electricity (by fuel type). For a copy of this report write to:

New England Energy Congress
14 Whitfield Road
Somerville, Massachusetta 02144
617/625-6528

. Who realizes energy cost savings/increases? This part of the ding/substitution effect is usually predetermined by the policies e d to encourage a particular energy source over another. For exampl ergy source is encouraged via mandatory requirements, then private will realize any energy cost savings or bear the burden of any cost ses.* Alternatively, if the use of a particular energy source is aged through Government subsidies (such as tax credits, subsidized , etc.), then the Government will pay for the difference in energy

. Behavior of energy consumers facing increased/decreased energy Once it is determined who realizes energy cost savings/increases, necessary to determine how these cost changes affect consumption an ment. It is particularly difficult to determine these effects if t

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ublic sector also realizes energy cost savings/increases if it is ed to use a particular energy source (e.g., in public housing or mi ngs).

If private energy consumers experience changes in energy costs, are several steps in estimating the effect of these changes on consu investment patterns. First, it is neceasary to determine the types users affected by the energy policy (i.e., households or businesses) usually determined by the energy regulations themselves: many of th directed towards specific end-use sectors (i.e., residential, commerc industrial*). Analysis of energy consumption patterns by sector may if a general energy source is encouraged by the policy in question (or gas). This information can be obtsined from local energy compani utilities, or local, state and national energy offices (see the refe section A above).**

Second, it is necessary to determine the extent to which an add dollar of income is consumed or aaved/invested by households and bus The following references are useful for obtaining this information:

- <u>Sourcebook: Statistics of the Income; Active Corporation In Returns</u>, U.S. Internal Revenue Service, provides information corporate profit levels, percentage reinvested and percentag as dividends. Available for reference use in most major lib

- <u>The BLS 1972/1973 Consumer Expenditure Survey</u>, provides info on taxes and consumption expenditures averaged over responde income class. This information can be used to estimate cons fraction of disposable income, or to analyze categories of c expenditures. For results of this survey, free of chsrge, c

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*Residential energy use is usually attributed to households. Commer energy use refers to the use of energy in commercial/industrial buil Industrial energy use usually refers to the use of energy for indust processes.

**In addition, information on energy use by industry is available in <u>Annual Survey of Manufacturera: Fuel and Electric Energy Consumed b Manufacturers</u>, Bureau of Census, which contains data for the Nation, SMSA's. Reports are available from the Government Printing Office f dollars. Data tapes are available from Data Users Services Division Census, for about $80.

Washington, D.C.
202/523-9637

. The employment effects of respending/substitution. Once the effect
ergy cost savings/increases on consumption and investment are determine
necessary to relate these effects to changes in the level of employmen
arnings) in the economy. There are several methods that have been use
studies to determine this relationship:

- Input-output coefficients. The multipliers associated with the hous sector in I-O models can be used to determine the average number of labor years and earnings per million dollars of disposable income sp in (or withdrawn from) the region. This procedure can only be used I-O models that include households in the A-matrix (such as RIMS). procedure is used in:

The Long Island Jobs/Energy Study, Council on Economic Prioriti (April 1979 FINAL DRAFT).
Contact: Steven Buchsbaum
CEP
84 Fifth Avenue
New York, New York 10011
212/691-8550

See also:

Energy and Labor Impact of Final Demand Expenditures, 1963 and 1967, Robert A. Herendeen, et al., Center for Advanced Computat University of Illinois, CAC Technical Memo No. 62 (October 1976
Cost: $3.00.

Labor and Net Energy Effects of a National Ceiling Insulation Program, Charlotte Ford, CAC publication (September 1978).
Contact: Charlotte Ford, CAC
217/333-3242

This latter publication indicates that, in 1967, money invested in average investments produced 9.2 jobs per $100,000 while money spent

Creation of Labor Data for 1963, 1967 and 1972, by Donna A
Technical Memo No. 77 (September 1976). Cost: $5.00.

o Income elasticities. For I-O models that exclude households in
A-matrix, the implicit income elasticities in macroeconomic mod
be used to estimate how a change in income will affect various
tion items. These changes can then be "mapped" into an I-O mod
structure to produce estimates of total final demand, earning a
employment. This has been done using the 1978 version of the D
Quarterly Macroeconomic Model of the U.S. Economy and the BLS n
I-O model. See:

Macroeconomic Impacts of Utility Retrofit Program-Solar.
(DRAFT: September 1978)
Science Applications, Inc./JRB Associates, Inc.
8400 Westpark Drive
McLean, Virginia 22102
Contract No. EM-78-C-04-4261
Contact: Jerry Lawry
202/821-4325

The Data Resources, Inc. Model, Otto Eckstein, Lexington,
Massachusetts (1978) "Consumer Spending," Table 2.

The preceeding discussion is designed to provide the policy decisi
a list of relevant considerations and sources of information for d
responding effects of energy policy choices. This list is by no me
ustive: It represents a useful starting point for continuing resea
ysis in this area.

Part 5. Financing Effects. As discussed briefly in section I, th
employment effect of a policy choice will also depend on the way th
gy investment is financed. The financing effects of energy policie
require estimation in almost all cases where the economy in questi
arge and diversified. For small, undiversified economies, financin
the energy investment will generally draw funds from outside the re
n the exception of direct local taxation).

In order to estimate the financing effects, it is necessary to det

Most of the discussion presented in part 4 ("Respending/Substitutio
ects") applies here. The answer to question 1 will usually be prede-
mined by the policies established to encourage a particular energy so
r another. Question 2 can be answered using the same references pres
: 4D. As in the case of respending/substitution effects, it is diffi
ermine the effects of financing on employment/earnings when public de
source of funding. If the investment is financed through private de
umptions must be made about the terms (length and interest rate) of t
order to determine the annual amount of funds being diverted from con
enditures or savings/ investment. In addition, several "sensitivity
be done by varying the types of policies used to finance solar (e.g.
dits, grants, tax exempt bonds, interest subsidies). Comparing the e
nings effects associated with each policy alternative may provide a b
osing the optimal policy.

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olic investment is not directly included here because it is, in effec
anced through either increased taxation (and hence reduced consumptio
estment) or public debt.

APPENDICES

This appendix presents, primarily in table form, a review of direct indirect labor requirements for energy technologies from various writte ces. It is expected that the policymaker can select pertinent informat these tables, and make additions to this data when other, more specif rmation is available.

(1) Table A-1. This table summarizes the results of several studies the direct labor requirements of solar flat-plate collector syste

(2) Table A-2. This table summarizes the results of several studies (including those sources for table A-1) on the direct and indirec labor requirements for passive solar and solar flat-plate collect systems.

(3) Table A-3. This table summarizes the results of a MITRE study o direct labor requirements for solar technologies, exclusive of fl plate collector systems.

(4) Tables A-4 to A-14. These tables summarize the results of a 197 Argonne National Laboratory study* which evaluated the construct and operating labor requirements of various sized facilities for of eight separate technologies: coal extraction, oil shale extra and conversion, offshore oil and gas extraction, nuclear powerpl coal-fired electric generating plants, gasification, liquefacti plants, and geothermal facilities.

(5) Table A-15. Summarizes the results of a 1978 study by Charlotte Ford at the Center for Advanced Computation, University of Illin The study estimates the direct and indirect labor requirements f manufacture, transportation, sale and installation of insulation

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ramework for Projecting Employment and Population Changes Accompanying gy Development: Phase I. Erik Stenehjem and James E. Metzger, Energy ronmental Systems Division, Argonne National Laboratory, Argonne, Illi st 1976.

estimates relate to a program that includes:

- o Retrofitting one-half of the 116,500 schools and co Nation. Measures would include installing weather caulking, insulation and double-glazed windows.

- o Retrofitting one-half of the 6,000 non-Federal, no hospitals in the United States (measures are same

- o Retrofitting all of the 403,000 Federal buildings are same as above).

- o Weatherizing 1.35 million homes occupied by low-in The program would be run by state and local govern

- o Weatherizing 50,000 HUD-owned single-family homes solar water heaters in 10,000 of these homes.

- o Constructing 4,000 miles of bikeways for which fun are already pending.

(7) Table A-17. The Environmental Protection Agency's Ac is an excellent "how to manage" manual for communitie prospect of accelerated growth. Volume I provides wo estimating peak employment and population projections types of energy development activities. The portions calculating direct employment effects are presented i

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*The FEA analyses are summarized by S. Lynn Sutcliff and Allan Senate Commerce Committee memorandum submitted to the Carter Tr (December 14, 1976).

**The Action Handbook (EPA 9081/4-78-005a) is available, free o Joel Webster, EPA, Region 8, 1860 Lincoln Street, Denver, Color 303/837-4904.

summarizes the wage rates for technical, nontechnical and manua
by energy facility. Table A-19 presents total construction ma
costs, calculated as the products of the hourly rates in table
and the original man-hour estimates from ESPM. Descriptions o
energy facilities included in ESPM are available in:

> <u>Resource Requirements: Impacts and Potential Constrsints Associated with Various Energy Facilities</u>. Research and Engineering, Bechtel National, Inc. (San Francisco, August 1978) Appendix B.

(9) <u>Table A-20</u>. This table summarizes the direct labor requiremen
for a 4 MWe wind turbine generator, as estimated in a Lockhead
Aircraft mission analysis for ERDA.***

In addition to the studies mentioned above, a forthcoming book
Steve H. Murdock and Larry Leistritz summarizes the direct emp
requirements and indirect employment multipliers for typical W
energy resource development projects:

> <u>Energy Development in the Western United States: Impact on Rural Areas</u>. New York: Praeger Publishers, 1979 (in press).

> Contact: Larry Leistritz
> Department of Agricultural Economics
> Texas A&M University
> College Station, Texas 77843
> 713/845-2333.

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scalation in the Costs of Manpower, Materials and Equipment Needed for
cilities. Research and Engineering, Bechtel Corporation (San Francisc
tober 1977) PAE-3794-F.

See section 3, part I for a description of the ESPM data base.

*Lockhead Aircraft Corporation, Wind Mission Analysis Study for ERDA,
port. LR-27611, 1976. A summary of these results are published in:
gh Potential of Wind as an Energy Resource." U. Coty and M. Dubey. L
California Company, Second Annual Energy Symposium, Los Angeles Counci
gineers and Scientists, May 19, 1976.

Type of System	Low	Mid	High
Hot Water	0.55	0.76	1.0
Hot Water, Space Heat	0.45	0.55	0.64
Hot Water, Space Heat, Space Cooling	0.68	0.79	1.1
	Direct Employee Hours per MMBtu/year (on an actual energy output basis per year of system operation)[b]		
Hot Water	2.04	2.81	3.70
Hot Water, Space Heat	3.46	4.23	4.92
Hot Water, Space Heat, Space Cooling	4.25	4.94	6.88

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[a]Direct employment here includes collector manufacturing, system installation and maintenance. It does not include component manu

[b]Calculations are based on the following estimatea of heat output foot of collector: Hot Water, 0.27 MMBtu (actual)/ft^2; Space Hea 0.13 MMBtu (actual)/ft^2; and Space Heat/Space Cooling/Hot Water, (actual)/ft^2.

$$\text{eh/MMBtu/year} = \frac{\text{eh}}{\text{ft}^2} \times \frac{\text{ft}^2}{\text{MMBtu}}$$

Virginia: MITRE Corporation, MITRE Working Paper No. 12569 (Septe

arles G., et al., Assessment of Need for Developing and Implementin al and Skilled Worker for the Solar Energy Industry, Final Report, na, Texas: Navarro College (DOE No. EG 77-S-104-3869 (January 13,

eve and Fred Branfman, Job from the Sun; Employment Development California Solar Energy Induatry, Los Angeles, California: Califorr Policy Center (February 1978).

n, Keith Armington, Direct Labor Requirements for Select Energy ogies: A Review and Synthesia. SERI Working Paper, August 1978.

acts of Solar Energy Development, Report to the Impacta Panel by th ent Impacta Task Force, Advanced Energy Systems Policy Division, U. ent of Energy, September 1978.

System	Direct Labor	Indirect Labor	Tota
Passive	1.70	2.60	4.3
Hot Water	2.81	5.62	8.4
Hot Water, Space Heat	4.23	8.46	12.6
Hot Water, Space Heat, Space Cooling	4.94	9.88	14.8

SOURCES: Estimates for passive are based on assumptions used by th Impacts Task Force, Labor Impacts of Solar Energy Develo Domestic Policy Review of Solar, Advanced Energy Systems Division, USDOE. September 21, 1978, p. 9.

Estimates for flat-plate collector systems are based on (direct) and independent input-output estimates from BLS Herendeen, Center for Advanced Computation, University of (see Task Force Report cited above).

:e	Technology	Demand Type	Capacity MW	Capacity Factor	MY/KW	MHR/MMBtu/yr. (Actual)	Costs $/MMBtu	Cost $/MMBt
	Solar Thermal Central Receiver, 3-hour storage	Semi Peak	100	0.35	0.013	2.32	31.93	22.26
	Solar Thermal Central Receiver, 6-hour storage	Semi Peak	100	0.50	0.017	2.12	32.69	23.84
	Solar Thermal Central Receiver	Fuel Saver	100	0.30	0.010	2.09	32.69	24.00
	PV with Storage Collector/Reflector 16% Silicon	Semi Peak	100	0.30	0.025	4.25	44.33	26.57
	PV with Storage Collector/Reflector 10% Thin Film	Semi Peak	100	0.30	0.041	3.33	34.82	20.85
	PV with Storage Collector/Reflector 16% Silicon	Intermed.	100	0.45	0.04	4.62	48.20	28.96
	PV with Storage Collector/Reflector 10% Thin Film	Intermed.	100	0.45	0.067	3.96	38.56	23.12

: All estimates are in terms of actual energy output. In order to convert these date to a MMBt oil displaced basis, all estimates would be divided by three (i.e., 1 Btu produced at the poi the equivalent of 3 Btu input in the form of primary energy, following the rule for electrici that it takes 10,400 Btu of primary energy to generate 1 kWh of electricity, versus the actua of 3,413 Btu per kWh).

TABLE A-3 (continued)

Technology	Demand Type	Plant Capacity MW	Capacity Factor	Direct Labor: Fabrication/Shipping/Install MY/KW	MHR/MMBtu/yr. (Actual)	Capital Costs $/MMBtu	Material Costs $/MMBtu
PV with Storage 10X Concentration/ Verticle Tracking	Intermed.	100	0.45	0.045	6.33	65.86	39.44
PV Collector/ Reflector 16% Silicon	Fuel Saver	100	0.28	0.017	3.21	33.43	20.02
PV Collector/ Reflector 10% Thin Flim	Fuel Saver	100	0.26	0.027	2.43	25.46	15.24
PV 10XCPC/ 16% Silicon	Fuel Saver	100	0.30	0.035	6.06	63.17	37.89
WECS with Hydro-Electric Hybrid	Intermed.	100	0.48 18 mph	0.0054*	0.705	17.96	15.02
Advanced WECS with Gas Turbine	Intermed.	100	0.49 14 mph	0.0050*	0.678	21.08	18.26
Advanced WECS with Combined Cycle	Baseload	100	0.87 18 mph	0.0085*	0.612	13.58	11.03
WECS	Fuel Saver	1.5 22.4 mph	0.30	0.0051*	1.065	23.02	18.58

TABLE A-3 (continued)

ogy	Demand Type	Plant Capacity MW	Capacity Factor	Direct Labor: Fabrication/Shipping/Install MY/KW	Direct Labor: Fabrication/Shipping/Install MHR/MMBtu/yr. (Actual)	Capital Costs $/MMBtu	Material Costs $/MMBtu	Indirec Labor MHR/MMBt (Actual
d WECS	Fuel Saver	1.5 17.1 mph	0.65	0.0085	0.619	14.04	10.63	0.89
red Steam	Intermed.	100	0.05	0.007	0.676	17.05	13.25	1.12
red Steam	Baseload	100	0.80	0.008	0.627	10.65	8.04	0.67
eated -Processing		68,750 MMBtu			0.990	8.73	9.00	0.50
Hot Air ryer		70,200 MMBtu			0.657	9.85	7.11	0.59
Hot Water hing System		38,250 MMBtu			0.561	9.22	6.88	0.57
° Hot Air Curing		29,565 MMBtu			2.010	26.48	15.89	1.33
ectric dam erplant	Baseload	0.981 x 10^9 kWh			0.702	8.46	4.93	0.414
plant	Baseload	264.5	0.61		2.622			1.676
plants	Baseload		0.61		2.001			1.134

TABLE A-3 (continued)

ce	Technology	Demand Type	Plant Capacity MW	Capacity Factor	Direct Labor: Fabrication/Shipping/Install MY/KW	Direct Labor: Fabrication/Shipping/Install MHR/MMBtu/yr. (Actual)	Capital Costs $/MMBtu	Materi Cost $/MMBt
	OTEC 7 plants	Baseload	264.5	0.61		1.535		
	Biomass-Methanol		3.82 x 10^6 MMBtu			0.405	4.23	
	Biomass-Medium Btu Gas		6.34 x 10^6 MMBtu			0.099	1.03	0.62
	Biomass-Substitute Natural Gas		5.58 x 10^6 MMBtu			0.198	2.09	1.25
	Biomass-Process Heat 850 ton/day	Steam	3.86 x 10^6 MMBtu			0.192	2.01	1.20
	1,700 ton/day	Steam	8.40 x 10^6 MMBtu			0.135	1.43	0.88
	3,400 ton/day	Steam	17.64 x 10^6 MMBtu			0.105	1.09	0.66

TABLE A-3 (continued)

:E: Unit labor estimates computed from data presentes in:

-- Systems Description and Engineering Costs for Solar-Related Technologies, Volume I, Summary
MITRE Corporation, Metrek Division, June 1977.

-- Systems Description and Engineering Costs for Solar-Related Technologies, Volume III, Agric
and Industrial Process Heat. The MITRE Corporation, Metrek Division, June 1977.

-- Escalation in the Costs of Manpower, Materials, and Equipment Needed for Energy Facilities,
Corporation, October 1977. Resource Requirements, Impacts, and Potential Constraints Assoc
Various Energy Futures. Bechtel National, Inc., March 1978.

-- Systems Descriptions and Engineering Costs for Solar-Related Technologies, Volume VII, Ocea
Energy Conversion. The MITRE Corporation, Metrek Division, June 1977.

-- Systems Description and Engineering Costs for Solar-Related Technologies, Volume IX, Biomas
Production and Conversion System. The MITRE Corporation, Metrek Division, June 1977.

Region, Size and Type of Coal	Personnel		
	Production	Maintenance	Supervision
Eastern (Bituminous)			
1MM	37	22	18
3MM	63	38	28
5MM	100*	54	24
Interior (Bituminous)			
1MM	40	23	15
1MM	36	23	16
1MM	57	18	18
3MM	68	29	15
6.7MM	106*	54	24
N. Great Plains (Subbituminous)			
1MM	27	11	9
5MM	66	18	11
5MM	53	22	14
9.2MM	126*	63	24
Southwest (Lignite)			
1MM	29	11	9
5MM	74	32	17

*Production figures include reclamation and road building.

SOURCE: Basic Estimated Capital Investment and Operating Costs fo Strip Mines, U.S. Department of Interior, Bureau of Mines Circulars 8661 (1975) and 8703 (1976).

Note: All mines were assumed to have a 20-year life. The Argon compared BOM data with two other sets of data on employme mines (A-5 and A-6). The Argonne study concludes that "T ment picture understates the actual mine performances ... to 33 percent, depending on the size of mine. The user c must be aware of the probable underestimation that strict these figures involves."

am				
I	202	11	44	257
I	390	15	59	464
I	585	18	74	677
am				
I	192	11	43	246
I	357	15	56	428
I	544	18	71	633

: Basic Estimated Capital Investment and Operating Costs for Undergro Bituminous Coal Mines, U.S. Department of Interior, Bureau of Mines Information Ciculars 8689 (1975) and 8682A (1976).

All mines were assumed to have a 20-year life.

Location	Technique	Tons/Year	Manpower	Seams
E. Kentucky	multi-pit	1.75M	200	18",22",40
Tennessee	contour & multi-pit	.35M	85	65",54",27 24"
West Virginia	modified block cut	.085M	14	17"
Pennsylvania	"typical dragline" "previous stripping of outcroppings"	.5M	33*	42"
W. Pennsylvania	"previous contour stripping"	.12M	24	24-28"
W. Pennsylvania	"family type of organization"	.24M	19	48-60"
Ohio	1 of 8 active pits	.6M	99	47"
Ohio	modified area technique	.14M	38	34"
S. Illinois		.3M	157	5′,3.5′ (2 pits)
S. Indiana	"typical Midwest mine"	.144M	157	54"
Colorado	large corporate structure, "traditional technique"	1.8M	99	7-10′, 4′ (2 pits)

*Some contracting of work.

oming	3M	102	3-20′	"geologic structure very complex"
ntana	5M	162	52"	unknown
kota	2M	70	20′ (total for 3 pits)	60′

Economic Engineering Analysis of U.S. Surface Coal Mines, Skelly & Loy Consultants, 1975; chapter 9, pp. 1-186.

Location	Output	Manpower	Width of Seams
Eastern	.73MM	62	3′,8′ (two pi
Midwest	1.45MM	166	45′
Northern Great Plains	3.30MM	137	24′,8.5′ (two
Southwest	7.00MM	454	unknown

SOURCE: Operation Study of Selected Surface Coal Mining Systems United States, Theodore Barry and Associates, NTIS PB-24 1975.

elop- nt	Support Services	Plat- forms	Pipeline Terminals	Gas Processing Plants	Office	Opera- tions Base	Construc- tion	Plat- form Construc- tion Facility	Total[a]	Tot
	58						40		263	26
	58							120	343	34
	58							347	735	73
	58						40	345	1103	110
95	116	16					40	345	1372	137
55	116	48					397	365	2041	204
15	174	112			14	45	467	363	2715	271
45	232	160	17	34	14	45	40	390	2602	260
05	232	240	17	34	14	45		419	2766	276
00	290	320	17	34	14	45	207	452	3339	333
55	348	848	34	68	45	145	367	500	4285	428
	58	960	51	102	77	250		(500	2163)	166
	58	848	51	68	67	218		(500	1975)	147
	58	400	17	34	31	100		(500	1305)	80

cility continues construction after year 16 for other areas.

atform contruction ceases after year 16.

rom calculations by Woodward-Clyde Consultants, Mid-Atlantic Regional Study, Table 2-2.

med that the productive life of the oil and gas fiels was 22 years, with 8 years of exporation at. The Argonne study recognizes that "further development is, of course, a possibility, if new finds are made. Users of the employment projections must be award of this possibility they are of the small probability that nothing will be recovered beneath the seas."

TABLE A-9: CONSTRUCTION AND OPERATION MANPOWER REQUIREMENTS
FOR SELECTED NUCLEAR POWERPLANTS, BY YEAR

	BELLEFONTE[a]		MC CUIRE[b]		RIVER 8END[c]		SUSQUEHANNA[d]		HYPOTHETICA AVERAGE
	Alabama		North Carolina		Louisiana		Pennsylvania		—
	2430		2360		1870		2100		2200
oo Employment	2240		1810		2200		2500		2080
	170		200		100		77		140
	Construction Employ-Ment	Operation Employ-Ment	Constructioo Employ-Ment	Operatioo Employ-Ment	Coostructioo Employ-Ment	Operatioo Employ-Ment	Constructioo Employ-Ment	Operation Employ-Ment	Construction Employ-Ment
	850	0	850	0	100	0	300	0	395
	1500	0	1537	0	350	0	1800	0	1164
	2150	0	1810	0	1200	0	2300	0	1872
	2240	30	1654	0	2100	0	2500	0	2080
	1660	155	950	30	2000	0	2400	0	1810
	630	170	200	170	1650	0	1500	0	1221
	0	170	0	200	1000	30	800	0	479
	0	170	0	200	300	70	250	20	0
	0	170	0	200	0	100	100	60	0
	0	170	0	200	0	100	0	77	0
	0	170	0	200	0	100	0	77	0
	0	170	0	200	0	100	0	77	0

reliminary Safety Analysis Report, 8ellafonte Nuclear Plaot, Tennessee Valley Authority.
avironmental Report, Operating License Stage, William B. McGuire Station, Uoits 1 & 2, Duke Power Company.
avironmental Report, Construction Permits Stage, River 8end Uoits 1 aod 2, Gulf States Utilities Compaoy.

COAL-FIRED ELECTRIC GENERATING PLANTS, BY YEAR

	Colstrip 3 & 4[a]		Tombigbee 2 & 3[b]		Kaiparowits (4 Units)[c]		Jim Bridger (2 Units)[d]		Bechtel - Lo[e]		Bechte
	Montana		Alabama		Utah		Wyoming		—		-
	700		420		3000		500		800		80
	No		No		Yes		Yes		No		No
n	1750		1200		3105		3000		2850-4071		2400-
	693		450		3135		282		125		10
ıc- -	Operations Employment	Construction Employment	Operations Employment	Construction Employment	Operations Employment	Construction Employment	Operations Employment	Construction Employment	Operations Employment	Construction Employ ment	O t E
	0	180	0	466	0	450	0	90	0	77	
	0	972	0	2515	0	2430	0	956	0	806	
	0	972	0	2515	0	2430	0	1972	0	1661	
	173	180	112	466	783	450	70	1861	0	1565	
	693	0	450	0	3135	0	282	821	31	691	
	693	0	450	0	3135	0	282	0	125	0	
	693	0	450	0	3135	0	282	0	125	0	
	693	0	450	0	3135	0	282	0	125	0	
	693	0	450	0	3135	0	282	0	125	0	

raft Environmental Impact Satement for Colstrip Electric Generating Units 3 and 4, Energy Planning Division, Mon
tate Department of Natural Resouces and Construction, Helena, Montana, November 1974, Vol. 3-A, p. 181,

a Environmental Analysis, Tombigbee Power Plant Site, Leroy, Alabama, Burns and McDonnell, Kansas City, Mo., 197
. B-51, 52.

nvironmental Impact Statement, Kaiparowits Project, Bureau of Land Management, Department of the Interior. March

raft Environmental Impact Statement for Jim Bridger Power Plant.

he Energy Supply Planning Model, Bechtel Corporation, NTIS PB-245382, August 1975.

TABLE A-11: CONSTRUCTION AND OPERATION MANPOWER REQUIREMENTS FOR OIL-SHALE CONVERSION PROCESSES, BY YEAR

	Project Independence[a]				EIS Prototype[b]				Bechtel[c]		
s	Surface		In-Situ		Surface		In-Situ		Surface		
	Construction Employment	Operations Employment	Construction Employment	Operations Employment	Construction Employment	Operations Employment	Construction Employment	Operations Employment	Construction Employment	Operations Employment	Con tio Emp me
:											
	678	0	914	0	1470	0	1240	0	1376	0	82
	1220-1470	0	1827	0	1470	0	1240	0	4121	0	331
	678	277	914	289	1470	323	1240	359	5963	0	501
	0	1110	0	1158	0	1293	1240	1435	5040	385	448
	0	1110	0	1158	0	1293	1240	1435	4485	1138	374
	0	1110	0	1158	0	1293	1240	1435	0	1138	
	0	1110	0	1158	0	1293	1240	1435	0	1138	
	0	1110	0	1158	0	1293	1240	1435	0	1138	

s: (a) Interagency Task Force on Oil Shale, Federal Energy Administration, Project Independence Blueprint Fina Washington, D.C., November 1974, quoted in Synthetic Fuels Commercialization Program, Draft Environment Statement, Washington, D.C., November 1975.

(b) EIS for the Prototype Oil Shale Leasing Program, U.S. Department of Interior, Vol. I, pp. III-247 and 2

(c) The Energy Supply Planning Model, Bechtel Corporation, NTIS PB-245382, 1975.

TABLE A-12: CONSTRUCTION AND MANPOWER REQUIREMENTS FOR COAL GASIFICATION, BY YEAR

FEA-HI[a]		FEA-LO[a]		WESCO[b]		EL PASO[c]		MICHWIS[d]	NATIONAL
uc- -	Operations Employment	Construction Employment	Operations Employment	Construction Employment	Operations Employment	Construction Employment	Operations Employment	Operations Employment	Operatio Employme
	0	68	0	2050	0	330	0	0	0
	0	157	45	3450	0	1998	33	0	0
	223	197	181	4300	153	3617	586	1026	231
	891	0	181	3450	612	2056	1234	1539	925
	891	0	181	4300	612	3296	1806	2052	925
	891	0	181	3450	612	1757	2628	2565	925
	891	0	181	4300	612	294	3009	3078	925
	891	0	181	3450	612	0	3009	3591	925
	891	0	181	2050	612	0	3009	4104	925
	891	0	181	0	612	0	3009	4104	925
	891	0	181	0	612	0	3009	4104	925
	891	0	181	0	612	0	3009	4104	925

nteragency Task Force on Synthetic Fuels from Coal, Federal Energy Administration Project Independence Blueprint
inal Task Force Report, Washington, D.C., November 1974.

raft Environmental Statement, WESCO Complex, Oepartment of Interior Bureau of Reclamation, 1-74; pages I-66 and
-71.

raft Environmental Statement, El Paso Gasification Project, chapter 3, table 3-11, page 54.

oal and Water for Future Gasification, Michigan-Wisconsin Pipe Line Company, February 1973, section II, page 6.

ummary Description, Dunn Center Coal Gasification Project, National Gas Pipeline Company, 1975.

	Fischer-Tropsch[a]		Direct[a]		Bechtel-
Years	Construction Employment	Operations Employment	Construction Employment	Operations Employment	Construction Employment
1	283	0	286	0	200
2	495	0	569	0	1200
3	510	0	569	0	2100
4	758	148	490	138	2300
5	191	593	186	554	1200
6	0	593	0	554	0
7	0	593	0	554	0
8	0	593	0	554	0
9	0	593	0	554	0
10	0	593	0	554	0
20	0	593	0	554	0
30	0	593	0	554	0

SOURCES: (a) Interagency Task Force on Synthetic Fuels from Co Energy Administration Project Independence Bluepr Force Report.

(b) Bechtel Energy Supply Planning Model.

Location	GEYSERS[a]		IMPERIAL VALLEY[b]		BECHTEL[c]	
Output	110 MWe		135 MWe		200 MWe	
Number of Wells	12-20		20-30		Undetermined	
Peak Construction	30		80		374	
Operations	81		10		83	
Years	Construction Employment	Operations Employment	Construction Employment	Operations Employment	Construction Employment	Oper tion Empl ment
1	20	0	40	0	126	0
2	20	20	80	10	374	0
3	0	81	40	10	265	21
4	0	81	0	10	228	60
5	0	81	0	10	0	83
10	0	81	0	10	0	83
20	0	81	0	10	0	83
30	0	81	0	10	0	83

SOURCES: (a) Conversation with Union Oil representative.

(b) Conversation with Pacific Gas & Electric Company representative.

(c) Energy Supply Planning Model, Bechtel Corporation.

Note: Construction data for Geysers and Imperial Valley does not include the well digging, normally done on a contractual basis and employing appro imately 75 people per well. It is also unclear whether or not Bechtel

	Type of Insulation	
	Mineral Wool	Cellulose
	(person-yr. 1 ft.^{2})	(person-yr. 1
Manufacture--Total	$(8.430 + 7.306\ X^{**}) \times 10^{-7}$	5.090 x 1
direct	-	3.1124 x
indirect	-	1.9776 x
Transportation and Sale--Total	$(1.059 + 0.918\ X) \times 10^{-7}$	3.101 x 1
Installation (direct only)	$1/(352{,}500 - 7{,}833\ X^{*})$	1.120 x 1
<u>TOTALS</u>		1.939 x 1

*Includes labor requirements for the chemical inputs and for collecti
the newspaper.

**X = batt thickness in inches.

SOURCE: <u>Labor and Net Energy Effects of a National Ceiling Insulatio</u> <u>Program</u> by Charlotte Ford, Center for Advanced Computation, University of Illinois, Urbana-Champaign. (September 1978)

TABLE A-16: COSTS, DIRECT EMPLOYMENT AND ENERGY SAVINGS OF
SIX ENERGY CONSERVATION PUBLIC WORKS PROGRAMS

Program	Costs (million 1976 $)	DIRECT JOBS CREATED(a) Unskilled	Skilled(b)	Manuf.	Construction	Tot
Retrofit Public Schools & Colleges	290	16,500	1,500	2,000	-	20,0
Retrofit Hospitals	150	9,000	1,000	1,250	-	11,2
Retrofit Federal Buildings	250	15,000	1,000	2,000	-	18,0
Low-Income Weatherization	770	27,000	5,400	10,000	-	42,4
Weatherization & Installation of Solar Water Heaters in HUD Housing	42	2,100	200(c)	250(c)	-	2,5
Bike Path Construction	140	5,000	500	770	-	6,2
TOTAL	1,642	74,600	9,600	16,270	-	100,4

SOURCE: Senate Commerce Committee memorandum by S. Lynn Sutchffe and Alan R. Hoffman t
Transition Group (December 14, 1976).

Supervisors or carpenters (in the case of retrofits).

Since contracted labor is used to repair HUD-owned homes, public service employees may partially replace local labor.

Assumptions

- For most buildings, while a retrofit investment of $1 per square foot is propably cost effective (i.e., energy savings would repay the retrofit cost on a reasonable time scale), the most labor-intensive retrofit measures are associated with the first $0.10 of investment per square foot.

- Of every $3 spent on building retrofit, $2 goes for labor and $1 goes for materials (based on the labor/materials cost split characteristic renovation activities).

- Each unskilled or semi-skilled public service worker will receive $10,000 annually.

- Each skilled public service worker acting in a supervisory role will receive $15,000 annually.

- Each $40,000 of investment in materials will create one job in the manufacturing industry (this figure is an average of several industri and is also the figure specifically applicable to the insulation industry).

Strip Mining:		
: employment per 1 million tons/year put	17.5[2]	66[3]
Jnderground Mining:		
: employment per 1 million tons/year put	138[4]	345[3]
:ic Powerplant:[3]		
al fired, hydropower, nuclear)		
: employment per 1,000 megawatts capacity	1,000	130
nale Mining and Processing:[5]		
: employment per 1,000 barrels/day output	33	18
um Mining and Milling:[6]		
: employment per 100 tons uranium centrate produced/day	13	22
Gasification Plant:[3]		
: employment per million cubic feet/day acity	4.5	2.4

[1]These figures are estimates based on various actual experien
vary among energy facilities.

[2]Adopted from A Study of Social, Economic and Public Effects
Mines, Bickert, Browne and Coddington, 1976.

[3]Projects to Expand Fuel Sources in Western States, Bureau of

[4]Adopted from Baseline Environmental Report, Proposed, Long C
Mine, Dames and Moore, 1976.

[5]Oil Shale and the Future of a Region, Colorado West Area Cou
Governments, 1974.

[6]Draft Environmental Statement, Bear Creek Project, Rocky Mou
Company, 1976.

*Note: Large facilities may, because of economies of scale,
workers per unit of output than smaller facilities.

Numbers	March 1977 Dollars Per Man-Hour Technical	Nontechnical	Manual
North Alaskan Wells)	41.72	30.17	35.77
Alaskan Pipelines)	35.92	24.13	23.85
(Alaskan Export)	22.75	18.10	20.27
(Solar)	21.55	9.65	16.69
, 4, 10, 12, 13, 20, 21, 23, 25, -1, 6, 7, 8, 12, 13, 14, 17, 18 Gas Extraction and Handling)	20.95	15.08	17.89
, 9, 17, 18, 31, 32, 33, 34, 35, rough 49 (Processing)	17.96	8.45	14.31
ugh 69 and T-9 (Railroad, Generation)	14.37	8.45	15.50
16, 27, 28, 29, 30, 37 through g)	14.37	7.24	13.71
ugh 27 (Electrical Transmission ibution)	12.81	9.65	15.50
, 10, 11, 15, 16, 20 (Mobile s)	None*	None*	None*

tles of the groups are resultant identifiers of how the rates happe
ut. They were not preselected categories.

presents total construction manpower costs, calculated as the prod
urly rates above and the original man-hour estimates.

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acilities (e.g., trucks) are purchased directly and not built
ergy construction industry.

Escalation in the Cost of Manpower, Materials and Equipment Needed
Energy Facilities. Bechtel (1977).

E 1	Onshore Primary Oil Recovery - Lower 48	1,676	226	
E 2	Onshore Secondary Oil Recovery - Lower 48	691	121	
E 3	Onshore Enhanced Oil Recovery - Lower 48	1,194	181	
E 4	Offshore Oil Recovery - Lower 48 and South Alaska	5,762	905	1
E 5	North Alaskan Oil Recovery	5,447	1,810	2
E 6	High-Gasoline Refinery	48,487	5,406	16
E 7	Low-Gasoline Refinery	43,099	4,645	14
E 8	Heavy Fuel Oil Gasification	37,891	3,294	14
E 9	Naphtha Gasification	8,081	1,224	3
E10	Crude Oil Stockpile	5,866	1,056	3
E11	Alaskan Oil Export	38,670	5,430	24
E12	Offshore Crude Oil Import	10,685	2,564	3
E13	Onshore Oil Import	7,542	1,961	2
E14	Surface Oil Shale Mine	5,316	290	6
E15	Undeground Oil Shale Mine	12,283	652	3
E16	In-Situ Shale Oil Recovery	8,476	471	2
E17	Oil Shale Retorting and Upgrading	53,874	2,534	20
E18	Shale Oil Upgrading	44,895	2,534	17
E19	Onshore Conventional Gas Recovery - Lower 48	3,352	453	1
E20	Onshore Enhanced Gas Recovery - Lower 48	14,666	2,639	7
E21	Offshore Gas Recovery - Lower 48	8,904	1,131	5
E22	North Alaskan Gas Recovery	5,950	2,051	2
E23	Coal Mine Degasification	105	15	
E24	Alaskan LNG Export	93,262	18,099	45
E25	LNG Import	28,284	6,033	14
E26	Natural Gas Stockpile	4,400	1,056	2
E27	Underground Eastern Coal Mine	1,940	109	
E28	Surface Eastern Coal Mine	3,003	232	1
E29	Surface Western Coal Mine	3,649	268	
E30	Underground Western Coal Mine	1,940	109	

Coal Gasification - High-Btu Gas	66,445	3,379	237,526	30
Coal Gasification - Low- and Medium-Btu Gas	61,057	2,534	198,892	26
Coal Gasification - Methanol	77,219	14,359	286,176	37
Coal Liquefaction - Heavy Fuel Oil	26,937	4,223	71,544	10
Coal Solvent Refining	30,529	1,689	100,162	13
Coal Liquids Refinery	33,402	3,547	97,014	13
Surface Uranium Mine	1,049	43	6,212	
Underground Uranium Mine	632	22	1,934	
Uranium Mill	948	36	2,002	
Uranium Conversion	6,465	869	12,204	1
Uranium Enrichment - Diffusion	235,609	30,406	663,690	92
LWR Fuel Fabrication - No Pu Recycle	6,645	591	13,236	2
LWR Fuel Fabrication - Pu Recycle	5,621	304	12,349	1
HTGR Fuel Fabrication	20,293	1,436	52,513	7
FBR Fuel Fabrication	8,530	591	22,322	3
LWR Spent Fuel Reprocessing	67,702	4,983	169,702	24
HTGR Spent Fuel Reprocessing	16,701	1,183	41,496	5
FBR Spent Fuel Reprocessing	60,518	4,223	151,387	21
High-Level Waste Disposal	5,477	287	14,309	2
Solid Waste Collection/Separation Plant	280	21	1,118	
Oil-Fired Powerplant	7,758	2,196	55,804	6
Reconversion of Oil Powerplant to Coal	29	8	233	
Coal-Fired Powerplant - Low-Btu Coal	10,919	3,041	70,996	8
Coal-Fired Powerplant - High-Btu Coal	9,338	2,618	59,525	7
Coal/Waste Powerplant - Low-Btu Coal	10,631	1,351	31,002	4
Coal/Waste Powerplant - High-Btu Coal	9,769	1,014	26,352	3
Sulfur Oxide Removal	8,620	1,689	18,601	2
Low/Intermediate-Btu Gas-Fired Plant	6,178	1,689	43,403	5
High-Btu Gas-Fired Powerplant	5,603	1,439	34,103	4

E60	Conversion of Gas Plant to Goal	4,417	507	
E61	Combined Cycle Powerplant	4,417	1,183	
E62	Gas Turbine Powerplant	575	203	
E63	Fuel Gells	106	41	
E64	Light Water Reactor	35,916	10,980	1
E65	High-Temperature Gas Reactor	53,156	18,582	1
E66	Fast Breeder Reactor - LMFBR	45,973	10,980	1
E67	Dam and Hydroelectric Powerplant	7,758	465	
E68	Pumped Storage	21,119	1,351	
E69	Geothermal Power Complex	2,715	228	
E70	Solar Space Heating	18,964	6,660	1
E71	Solar Space Conditioning	20,688	7,240	1
T 1	Crude Oil Pipeline - Lower 48	3,519	407	
T 2	Alaskan Oil Pipeline	179,580	24,132	6
T 3	Oil Tanker	0	0	
T 4	Oil Barge	0	0	
T 5	Oil Tank Truck	0	0	
T 6	Products Pipeline	859	75	
T 7	Hot Oil Pipeline	796	60	
T 8	Refined Products Bulk Station	461	45	
T 9	Rail Line	2,457	144	
T10	Mixed Train	0	0	
T11	Coal Unit Train	0	0	
T12	Goal Slurry Pipeline	3,457	453	
T13	Coal Slurry Preparation	2,828	603	
T14	Coal Slurry Dewatering	1,990	151	
T15	Coal Barge	0	0	
T16	Coal Truck	0	0	
T17	Gas Pipeline - Lower 48	3,520	407	
T18	Gas Distribution Facilities	2,242	196	
T19	Alaskan Gas Pipeline	141,848	20,512	4
T20	LNG Tanker	0	0	
T21	230 kVac Transmission Line	6,405	1,110	
T22	345 kVac Transmission Line	7,814	1,544	

500 kVac Transmission Line	12,234	2,413	51,929
765 kVac Transmission Line	15,116	2,992	70,840
± 400 kVdc Transmission Line	12,938	2,317	55,339
Electricity Distribution - Aerial Lines	1,071	212	4,703
Electricity Distribution - Underground Lines	1,746	350	7,020

(1) Accuracy of information is seldom greater than three significant figures.

(2) May not add due to rounding.

Escalation in the Costs of Manpower, Materials and Equipment Needed for Energy Facilities. Bechtel (1977).

Labor Category	Person-Hours	Perso
Manufacturing	142,593	
Onsite Labor		
Site Preparation	2,000	
Transportation	951	
Assembly and Erection	9,494	
Foundation	4,444	
Onsite Subtotal	16,889	
Total	159,482	

[a]Using 1,920 hours/person-year.

SOURCE: Lockheed Aircraft Corporation, Wind Mission Analysis Stu
ERDA (Draft Report, LR-27611, 1976).

t incorporate solar technologies and conservation measures into the I-O mework. These include:

- o <u>Sector-Specific Output and Employment Impacts of a Solar Space and Heating Industry</u>, by H. C. Peterson, Utah State University, Logan, (1977). This study augments the direct requirements matrix of the I-O table to include the purchase requirements of an industry whic manufactures solar collectors and one which installs complete sola space and water heating systems.

  Available from: National Technical Information Service (NTIS)
  U.S. Department of Commerce
  Springfield, Virginia 22161

- o <u>The Long Island Jobs Energy Study</u>. Council on Economic Priorities (April 1979 FINAL DRAFT). This study develops a "bill of goods" for solar hot water systems, a nuclear powerplant and a variety of residential conservation measures. The bill of goods is identifie terms of SIC sectors, and can be readily applied to the BLS I-O an models.

  Contact: Steven Buchsbaum
  Council on Economic Priorities
  84 5th Avenue
  New York, New York 10011
  212/691-8550

- o <u>Labor and Net Energy Effects of a National Ceiling Insulation Prog</u> by Charlotte Ford, Center for Advanced Computation, University of Illinois, Urbana, Illinois (September 1978). This study develops of goods for cellulose ceiling insulation (see appendix B).

  Contact: Charlotte Ford
  Center for Advanced Computation
  University of Illinois
  Urbana, Illinois 51801
  217/333-3242

solar systems (hot water, hot water/space heating, hot water/spa
heating/absorption cooling, and auxiliary). The bill of goods
tailored to the national BLS I-O model.

Contact: Jerry Lawry
Science Applications, Inc.
JRB Associates
8400 Westpark Drive
McLean, Virginia 22102
202/821-4325

o <u>Energy, Employment, and Environmental Impacts of Accelerated In</u> <u>in Conservation and Solar Technologies in Buildings</u>. Steven C. Shirish Mulherkar, Jay Schwam, Department of Energy and Environ Brookhaven National Laboratory (PRELIMINARY REPORT, 1978). Thi develops a "bill of goods" for conservation and solar technolog residential/commercial buildings. The bill of goods is identif terms of BNL I-O Sectors.

Contact: David Kline
Project Moniter
U.S. Department of Energy
Room 2220
20 Massachusetts Avenue, NW.
Washington, D.C. 20545
202/376-4827

o <u>Analysis of the California Energy Industry</u>. Energy and Environ Division, Lawrence Berkeley Laboratory (January 1977). This st develops a bill of goods for passive solar housing construction additional insulation and double-glazed window units), delampin commercial buildings, retrofit ceiling insulation, wind turbine rators, solar thermal electric powerplants, and systems to conv municipal solid waste to energy.

Contact: Jayant Sathaye
Lawrence Berkeley Laboratory
University of California
Berkeley, California
415/451-6292

l.

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U.S. Government Printing Office
Washington, D.C. 20402

(1) Tables C-1 and C-2 present the various energy supply and transportation facilities contained in the Bechtel Energy Supp Planning Model.

(2) Table C-3 preaents the industrial groupings used in the Bureau Economic Analysis REIS, with Standard Industrial Classificatic Codes (SIC).

(3) Table C-4 presents the sectoral classification of the BNL I-O and alignment with other classification systems. The attachme this table describes the energy sectors in greater detail.

(4) Table C-5 presents sector descriptions of the RIMS state/censu multipliers.

(5) Table C-6A presents the economic sectors of the REAP I-O model corresponding SIC codes.

(6) Tables C-6B to C-6D display the REAP project data for three ty of energy supply: export mine, electric plant and SNG plant.

(7) Table C-7 presents the sectoral classification of the BLS I-O with corresponding SIC groups, and projected 1985 employment c ratios.

(8) Table C-8 presents the economic sectors of the RSRI I-O model corresponding SIC codes.

(9) Table C-9 presents the sectoral classification of the INFORUM and corresponding SIC codes.

2. On-shore Secondary Oil Recovery

3. On-ahore Enhanced Oil Recovery

4. Off-shore Oil Recovery

5. North Alaakan Oil Recovery

6. High-Gasoline Refinery

7. Low-Gasoline Refinery

8. Heavy Fuel Oil Gasification

9. Naphtha Gasification

10. Crude Oil Stockpile

11. Alaakan Oil Export

12. Off-shore Crude Oil Import

13. On-shore Oil Import

14. Surface Oil Shale Mine

15. Underground Oil Shale Mine

16. In SITU Shale Oil Recovery

17. Oil Shale Retorting and Upgrading

18. Shale Oil Upgrading

20. On-Shore Enhanced Gas Recover

21. Off-Shore Gas Recovery - Lowe

22. North Alaskan Gas Recovery

23. Coal Mine Degasification

24. Alaskan LNG Export

25. LNG Import

26. Natural Gas Stockpile

Coal

27. Underground Eastern Coal Mine

28. Surface Eastern Coal Mine

29. Surface Western Coal Mine

30. Underground Western Coal Mine

31. Coal Gaaification - High Btu

32. Coal Gasification - Low and Medium Btu

33. Coal Gasification - Methanol

34. Coal Liquefaction - Heavy Fue

35. Coal Solvent Refining

36. Coal Liquids Refinery

38. Underground Uranium Mine

39. Uranium Mill

40. Uranium Conversion

41. Uranium Enrichment

42. Light Water Reactor Fuel Fabrication - without Plutonium Recycle

43. Light Water Reactor Fabrication - with Plutonium Recycle

44. High Temperature Gas Reactor Fuel Fabrication

45. Fast Breeder Reactor Fuel Fabrication

46. Light Water Reactor Spent Fuel Reprocessing

47. High Temperature Gas Reactor Spent Fuel Reprocessing

48. Fast Breeder Reactor Spent Fuel Reprocessing

49. High-Level Waste Disposal

50. Solid Waste Collection/ Separation Plant

52. High Temperature Reactor

53. Fast Breeder Reactor

Utilities

54. Oil-Fired Power Plant

55. Reconversion of Oil Plant to Co

56. Coal Fired Power Plant - Low Bt

57. Coal Fired Power Plant - High B

58. Coal/Waste Power Plant - Low Btu Coal

59. Coal/Waste Power Plant - High Btu Coal

60. Sulfur Oxide Removal

61. Low/Intermediate Btu Gas Fired Plant

62. High Btu Gas Fired Plant

63. Conversion of Gas Plant to Coal

64. Combined Cycle Power Plant

65. Gas Turbine Power Plant

66. Fuel Cell Power Plant

67. Demand Hydroelectric Power

68. Pumped Storage

69. Geothermal Power Complex

70. Solar Space Heating

71. Solar Space Conditioning

72. Geopressed Gas Recovery

73. Coal Solvent Refining

74. Fluidized Bed (Atoms) Power Plant

. Alaskan Oil Pipeline
. Oil Tanker
. Oil Barges
. Oil Tank Truck
. Products Pipeline
. Hot Oil Pipeline
. Refined Products Bulk Station
. Rail Line*

22. 345 kVac Transmission Lir
23. 500 kVac Transmission Lir
24. 765 kVac Transmission Lir
25. 400 kVac Transmission Lir
26. Electricity Distribution Aerial Lines
27. Electricity Distribution Underground Lines

al

. Mixed Train+
. Coal Unit Train
. Coal Slurry Pipeline
. Coal Slurry Preparation
. Coal Slurry Dewatering
. Coal Barges
. Coal Truck

s

. Gas Pipeline
. Gas Distribution Facilities
. Alaskan Gas Pipeline
. LNG Tanker

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ail line applies to a general track of line which could be used to ansport both energy and non-energy supplies. It is not limited to e transportation of oil.

mixed train typically transports coal and other energy resources.

Agriculture	01, 07.
Forestry and fisheries	08, 09.
Mining:	
Metal	10.
Coal	11, 12.
Crude petroleum and natural gas	13.
Nonmetallic, except fuels	14.
Contract construction	15-17.
Manufacturing:	
Food and kindred products	20.
Textile mill products	22.
Apparel and other fabric products	23.
Lumber products and furniture	24.25.
Paper and allied products	26.
Printing and publishing	27.
Chemicals and allied products	28.
Petroleum refining	29.
Primary metals	33.
Fabricated metals and ordnance	34.19.
Machinery, excluding electrical	35.
Electrical machinery and supplies	36.
Motor vehicles and equipment	371.
Transportation equipment, excluding motor vehicles	37 except 371.
Other manufacturing	21, 30-32, 38,
Transportation, communications and public utilities:	
Railroad transportation	40.
Trucking and warehousing	42.
Other transportation and services	41, 44, 47.
Communications	48.
Utilities (electric, gas, sanitary)	49.
Wholesale and retail trade	50, 52-57, 59.
Finance, insurance and real estate	60-67.
Services:	
Lodging places and personal services	70, 72.
Business and repair services	73, 75, 76.
Amusement and recreation services	78, 79.

Government:	
Civilian government:	
Federal Government	91 except Fed. military.
State and local government	92, 93.
Armed forces	Part of 91.

URCE: Executive Office of the President, Bureau of the Budget, Standard Industrial Classification Manual, 1967.

1	Coal	1	7	7	7
2	Crude Oil	2	8	8	8
	Crude Gas				
3	Shale Oil	-	-	-	-
4	Methane from coal	3	-	-	-
5	Coal liquefaction	-	-	-	-
6	Refined oil products	4	31.01	part 31	part 41
7	Pipeline gas	5	68.02	68.2	93
8	Coal combined cycle electric	-	-	-	-
9	Other fossil electric	6	68.01		
			78.02		
			79.02		
10	LWR electric	7	68.01		
			78.02		
			79.02		92
				68.1	part 10
11	HTGR electric	-	-		part 10
	Hydroelectric	8	68.01		
			78.02		
			79.02		
12	Geothermal	-	-	-	-
	Solar electric	-	-	-	-
	Solar direct	-	-	-	-
13	Ore reduction feedstocks	9	-	-	-
14	Chemical feedstocks	10	-	-	-
15	Motive power	11	-	-	-
16	Process heat	12	-	-	-
17	Water heat	13	-	-	-
18	Space heat	14	-	-	-
19	Air-conditioning	15	-	-	-
20	Electric power	16	-	-	-
21	Livestock and livestock products	17	1	1	1
22	Other agricultural products	18	2	2	2

cultural, forestry and shery services	20	4	4	4	4
and ferroalloys ores ning	21	5	5	5	5
ferrous metal ores mining	22	6	6	6	6-
e and clay mining, arrying	23	9	9	9	10
icals and fertilizer neral mining	24	10	19	10	11
construction, residential buildings		11.01	11.1	11	12
construction, non-sidential buildings		11.02	11.2	12	13
construction, public ilities	25	11.03	11.3	13	14
construction, highways		11.04	11.4	14	15
construction, all other		11.05	11.5	15	16
tenance and repair nstruction, residential	26	12.01	12.1	16	17
tenance and repair nstruction, all other		12.02	12.2	17	
ance and accessories	27	13	13	18	18-
and kindred producta	28	14	14	19	20
cco manufacturers	29	15	15	20	21
d and narrow fabrics, rn and thread mills	30	16	16	21	22
. textile goods and oor coverings	31	17	17	22	23
rel	32	18	18	23	24-
. fabricated textile oducts	33	19	19	24	26

	except containers	34	20	20	25
44	Wooden containers	35	21	21	26
45	Household furniture	36	22	22	27
46	Other furniture and fixtures	37	23	23	28
47	Paper and allied products			24.1	29
	except containers and boxes	38	24	24.2	30
				24.3	31
48	Paperboard containers and				
	boxes	39	25	25	32
49	Printing and publishing	40	26	26	33
50	Chemicals and selected			27.1	34
	chemical products	41	27	27.2	35
				27.3	36
51	Plastics and synthetic			28.1	37
	materials	42	28	28.2	38
52	Drugs, cleaning and				
	toilet preparations	43	29	29	39
53	Paints and allied products	44	30	30	40
54	Paving mixtures and blocks	45	31.02	part 31	part 41
55	Asphalt felts and coatings	46	31.03	part 31	part 41
56	Rubber and miscellaneous			32.1	42
	plastics products	47	32	32.2	43
				32.3	44
57	Leather tanning and				
	industrial leather products	48	33	33	45
58	Footwear and other leather				
	products	49	34	34	46
59	Glass and glass products	50	35	35	47
60	Stone and clay products	51	36	36	48

nufacturing	52	37	37	49	49–
ary non-ferrous metals			38.1	50	51–
nufacturing	53	38	38.2	51	51–
			38.3	52	
l containers	54	39	39	53	58
ing, plumbing and bricated structural tal products	55	40	40	54	59–
w machine prod., bolts, ts, etc. & metal ampings	56	41	41	55	61
r fabricated metal oducts	57	42	42	56	62
nes and turbines	58	43	43	57	63
machinery	59	44	44	58	64
truction, mining, oil eld machinery, equipment	60	45	45	59	65
rials handling machinery d equipment	61	46	46	60	66
lworking machinery and uipment	62	47	47	61	67
ial industry machinery d equipment	63	48	48	62	68
ral industrial machinery d equipment	64	49	49	63	69
ine shop products	65	50	50	64	70
ce, computing and counting machines	66	51	51	65	71–
ice industry machines	67	52	52	66	73
. trans. & dist. eq. &			53.1	67	74
ec. industry apparatus	68	53	53.2	68	75

	communications equipment	71	56	56	71
81	Electronic components and accessories	72	57	57.1 57.2 57.3	72 73 74
82	Miscellaneous elec. machinery, equipment & supplies	73	58	58	75
83	Motor vehicles and equipment	74	59	59	76
84	Aircraft and parts	75	60	60	77
85	Other transportation equipment	76	61	61	78
86	Professional, scientific & controlling inst. & supp.	77	62	62	79
87	Optical, opthalmic, & photographic equip. & supplies	78	63	63	81
88	Miscellaneous manufacturing	79	64	64	82
89	Railroads and related services	80	65.01	65.1	83
90	Local, urban and inter-urban highway pass. trans.	81	65.02 79.01	65.2	84 part 10
91	Motor freight transportation and warehousing	82	65.03	65.3	85
92	Water transportation	83	65.04	65.4	86
93	Air transportation	84	65.05	65.5	87
94	Pipeline transportation	85	65.06	65.6	88
95	Transportation services	86	65.07	65.7	89
96	Communications except radio & television broadcasting	87	66	66	90

and sanitary services	89	68.03	68.3	94	103
esale and retail trade	90	69	69	95	104-
ace and insurance	91	70	70	96	106-
estate & rental	92	71	71	97	108-
ls & lodging; pers. & air serv., except auto air	93	72	72	98	110-
ness services	94	73	73	99	112-
mobile repair & vices	95	75	75	101	115
ements	96	76	76	102	116-
cal, educ., services on-profit inst.	97	77	77	103	118-
ral Government erprises	98	78.01	-	part 104	122
		78.04	-		124
e and local govern- t enterprises	99	79.03	-	part 105	part 1
ness travel, enter- nment & gifts	100	81	-	107	128
ce supplies	101	82	-	108	129
arch & development	-	74*	-	100	-
s imports	-	80	-	106	126
p, used and second d goods	-	83	-	109	130
rnment industry	-	84	-	-	131
of world industry	-	85	-	-	132
eholds	-	86	-	-	133
ntory valuation ustment	-	87	-	-	134

ed as a separate sector by BEA in the 1963 and 1967 studies.

Code:	BNL 110	- Brookhaven National Laboratory 110 sector version
	BNL 101	- Brookhaven National Laboratory 101 sector version
	BEA	- Bureau of Economic Analysis, U.S. Dept. of Commerce
	Battelle	- Battelle Memorial Institute; used in _An "Ex Ante" Capital Maxtrix for the United States, 1970-1975_
	A. Carter	- Professor Ann Carter, Brandeis University
	BLS	- Bureau of Labor Statistics, U.S. Dept. of Labor
	DRI 18	- Data Resources, Inc., 18 sector interindustry model

he first 12 sectors of the I-O are energy supply/conversion sectors transform basic energy resources into usable (product) forms of energ e of meeting final, end-use demand. They depict actual, physical tion processes and are defined below.

. Coal. The coal sector produces raw coal as it comes from the mine tal output is measured in Btu's of raw coal. It is assumed that sect sing this coal do their own crushing and cleaning.

. Crude Oil and Gas. This sector's total output is the summation of of crude oil at the wellhead and Btu's of associated and nonassociate ad gas that are produced domestically. As an accounting convenience, sing losses for domestic gas and refining losses for both imported an ic crude oil are represented by the diagonal A-matrix coefficient for .* This permits energy transfer from the crude oil and gas sector to fined oil products sector to be measured by Btu's of refined oil prod o permits energy transfer to the pipeline gas sector to be measured b of processed gas.

. Shale Oil. The shale oil sector produces a crude oil substitute, tal output is measured in terms of Btu's of crude oil. As an account ience, refining losses are represented by the diagonal A-matrix coeff and this sector actually transfers Btu's of refined oil products to d oil products sector.

. Methane from Coal. This sector produces a high Btu, pipeline-qual tic gas from coal by the HYGAS process. The coal input is considered coal, the same unit of measure as the output of the coal sector. Th ed is a direct substitute for processed natural gas, and all of it is red to the pipeline gas sector.

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er or not one accounts for energy conversion or distribution losses i rial as long as one is not formulating the I-O itself as an optimizat What is crucial, however, is the unit of measurement adopted for to (total domestic production) from each energy supply sector. This me orrespond with the units used to renormalize I-O coefficient column s for the energy sectors from dollars of input per dollar of output t s of input per Btu of output.

via coal liquefaction, new costs and conversion efficiencies have been calculated and inserted into BESOM.

6. Refined Oil Products. This sector refines all imported and d crude oil, domestic shale oil, and domestic liquefied coal. Its outpu measured by Btu's of refined petroleum products, and imports of refine are not included in the measure of domestic production.

7. Pipeline Gas. This sector, in essence, distributes high Btu, pipeline-quality gas, and total output is measured by Btu's of process gas produced domestically. Total output does not include imported pip from Canada or imported LNG, substitutes for that produced domesticall Consumption of gas by pipeline pumping stations is accounted for by a coefficient in the diagonal A-matrix entry for this sector. Transfers other sectors are therefore measured by Btu's of delivered gas at the utilization.

8. Coal Combined-Cycle Electric. This sector produces electrici combined low-Btu coal gasification and COGAS generation processes. To is measured by Btu's of generated electricity. Transmission and distr losses are tabulated in the diagonal A-matrix entry for this sector, a bution to all other sectors is measured by Btu's of distributed electr conventions adopted for all of the electric generation sectors.

9. Other Fossil Electric. This sector combines electricity prod from conventional coal-fired boilers, oil-fired boilers, gas-fired boi oil-fired gas turbines, oil-fired steam electric combined cycle, and o total energy systems.

10. LWR Electric. This sector produces electricity from light wa nuclear reactors.

11. HTGR Electric. This sector produces electricity from high-te gas-cooled reactors.

12. Hydroelectric. This sector combines electricity production f (1) hydroelectric generation plants; (2) geothermal steam electric-gen plants; (3) pumped storage plants; and (4) solar electric central inst Electrical transmission losses in the diagonal element of the A-matrix represented for the first two and the last electric generation methods for pumped storage.

13. Ore Reduction Feedstocks, ORF. This aector distributes coke fo
reduction purposes.

14. Chemical Feedstocks, CF. This sector distributes feedatocks fo
ical industries in the raw form used by those industries auch as naph
ane, as well as lubricants and greases used by all industries.

15. Motive Power, MP. This sector's output is measured in terms of
lable at a drive shaft for transport purposes regardless of the fuel
ide that power. Electric rail transport is not included, however.

16. Process Heat, PH. This sector supplies all heating requirement
uding industrial process heat, cooking heat, and clothes drying.

17. Water Heat, WH. The output of this sector is measured in terms
s of heat added to water for any purpoae other than steam for proceas
pace heat.

18. Space Heat, SH. The output of this sector is measured in terms
s of heat added to a building regardless of fuel or type of heating s

19. Air Conditioning, AC. This sector's output is Btu's of heat re
the air being conditioned.

20. Electric Power, EP. This sector'a output includes all
ubstitutable uses of transmitted and distributed electricity such as
ting, appliances, other electric drive, industrial electrolysis, etc.
tricity used for motive power in electric rail and maas transit syste
included in this sector.

A. 16-aector aggregation includes:

1. Agriculture
2. Non-fuel mining
3. Coal mining
4. Crude petroleum and natural gaa
5. Chemicals manufacturing
6. Petroleum refining
7. Motor vehicle manufacturing
8. Other manufacturing
9. Transportation
10. Sanitary servicea, communications, water
11. Electric utilities
12. Gas utilities
13. Trade
14. Finance, insurance, real estate
15. Services
16. Construction

B. 103-aector aggregation includea:

1.	Dairy farm products, poultry and eggs	0132, 0133, 0134, pt. 014
2.	Meat animals and miscellaneous livestock products	0135, 0136, 0139, pt. 014 0193, pt. 0729
3.	Cotton	0112, pt. 014
4.	Food feed grains and grass seeds	0113, pt. 0119, pt. 014
5.	Forest, greenhouse, and nursery products	0192, pt. 014
6.	Forestry and fishery products	074, 081, 082, 084, 086
7.	Other crops and services	pt. 0114, 0122, 0123 pt. 0119, pt. 0113 pt. 014, 071, 0723, 073 pt. 0729, 085, 098

<u>ining</u>

8.	Metal mining	10
9.	Coal mining	11, 12
0.	Crude petroleum and natural gas	131, 132
1.	Stone and clay mining and quarrying	141, 142, 144, 145, 148, 149
2.	Chemicals and fertilizer mineral mining	147

<u>onstruction</u>

3.	Residential buildings	pt. 15, pt.16, pt.17, pt.65
4.	Non-residential buildings	pt. 15, pt. 17

15.	New electric utility facilities	pt. 16, pt.
16.	New gas utility facilities	pt. 16, pt.
17.	New petroleum pipelines	pt. 16, pt.
18.	New local transit facilities	pt. 16, pt.
19.	New highways	pt. 16, pt.
20.	New oil and gas wells	pt. 138
21.	New oil and gas exploration	pt. 138
22.	Maintenance and repair of oil and gas wells	pt. 138
23.	All other construction	pt. 15, pt.

Manufacturing

24.	Meat products	201
25.	Dairy products	202
26.	Canned, cured, and frozen products	203
27.	Grain mill products	204
28.	Bakery products	205
29.	Beverages	208
30.	Miscellaneous food products	206, 207, 20
31.	Textile mill products	22
32.	Apparel and other fabric products	23

33.	Lumber products	24
34.	Furniture and fixtures	25
35.	Paper mills	262
36.	Paper products	26 (excl. 262)
37.	Printing and publishing	27
38.	Industrial inorganic and organic chemicals	281 (excl. 28195)
39.	Plastic materials and resins	2821
40.	Synthetic rubber	2822
41.	Other plastics and synthetics	2823, 2824
42.	Drugs, cleaning and toilet preparations	283, 284
43.	Paints and allied products	285
44.	Agricultural chemicals	287
45.	Carbon black	2895
46.	Miscellaneous chemical products	286, 289 (excl. 2895)
47.	Petroleum refining	2911, 299
48.	Paving mixtures and blocks	2951
49.	Asphalt felts and coatings	2952
50.	Rubber	30

51.	Glaas and glasa products	321, 322, 323
52.	Cement, hydraulic	324
53.	Clay	325
54.	Concrete, lime, and gypsum	327
55.	Other stone and clay producta	326, 328, 329
56.	Primary aluminum	3334, 28195
57.	Aluminum rolling and drawing	3352
58.	Primary iron and steel manufacturing	331, 332, 339 (exc
59.	Other primary metal manufacturing	333, 334, 335, 336 (excl. 3334, 3352)
60.	Fabricated structural ateel	3441
61.	Other fabricated metals, ordnance	34, 19 (excl. 3441
62.	Engines and turbinea	351
63.	Farm machinery	352
64.	Construction and materiala handling	353
65.	Metal working machinery	354
66.	Special industrial machinery	355
67.	General induatrial machinery	356
68.	Office and computing machinery	357

69.	Service and miscellaneous machinery, excluding electrical	358, 359
70.	Carbon and graphic products	3624
71.	Electrical apparatus and motors	361, 362 (excl. 3624)
72.	Household appliances	363
73.	Electrical lighting and wiring equipment	364
74.	Communications equipment	365, 366
75.	Electronic components	367
76.	Batteries and miscellaneous electrical equipment	369
77.	Motor vehicle and equipment	371
78.	Aircraft and parts	372
79.	Other transportation equipment	37 (excl. 371, 372)
80.	Instruments and clocks	381, 382, 384, 387
81.	Photographic equipment	383, 385, 386
82.	Other manufacturing	21, 31, 39

<u>Transportation, Communications, Public Utilities</u>

83.	Railroads	40, 474
84.	Trucking and warehousing	42, 473
85.	Air transportation	45

86.	Highway passenger transportation	41
87.	Water transportation	44
88.	Transportation services	47 (excl. 473, 474
89.	Pipeline transportation	46
90.	Communications	481, 482
91.	Radio and TV broadcasting	483
92.	Electric utilities	491, pt. 493
93.	Gas utilities	492, pt. 493
94.	Water and sanitary services	494, 495, 496, 497
Wholesale and Retail Trade		
95.	Wholesale and retail trade	50, 52-59, 7396, p
Finance, Insurance, Real Estate		
96.	Finance, insurance	60-67 (excl. 65)
97.	Real estate	65 (excl. pt. 6561
Services		
98.	Hotel and lodging places	70
99.	Auto repair and services	75
100.	Personal and repair services	72, 76 (excl. 7692 and pt. 7699)

101.	Business serivces	73 (excl. 7396), 7692, 7694, pt. 7699
102.	Amusement and recreation services	78, 79
103.	Professional services	80, 81, 82, 84, 86, 89 (excl. 8099)

1. Agr., Livestock	Group 013 - Livestock
2. Agr., Crops	All of Major Group 01 - Agricultur Production, Except Group 013 - Li
3. Coal Mining	Major Group 12 - Bituminous Coal a Lignite Mining
4. Contract Construction	Division G - Contract Construction Groups 15, 16, and 17)
5. Transportation	All Division E - Transportation, Co tions, Electric, Gas, and Sanita Services, Except Major Groups 48
6. Communication and Utilities	Major Group 48 - Communication and Group 49 - Electric, Gas, and Sa Services (Except Industry No. 491
7. Processing and Misc. Manufacturing[b]	Major Group 50 - Wholesale Trade a Group 20 - Food and Kindred Produ Manufacturing
8. Retail Trade	All of Division F - Wholesale and R Trade, Except Major Group 50 - Wh Trade
9. Finance, Insurance, and Real Estate	Division G - Finance, Insurance, a Estate
10. Business and Personal Services	All Division H - Services, Except M Groups 80, 81, 82, 86, and 89
11. Professional and Social Services	Major Group 80 - Medical and Other Services, Major Group 81 - Legal Services, Major Group 82 - Educat Services, Major Group 86 - Non-pr Membership Organizations, Major G Miscellaneous Services
12. Households	Not Applicable
13. Government	Division I - Government

[a]Executive Office of the President/Bureau of the Budget, Standard Industrial Classification Manual, 1967, U.S. Government Printing Washington, D.C., 1967.

[b]Wholesale trade, although relatively insignificant, is included Sector 7.

& 13	1982	28	NOKOTA Two 3.3 MTPY Lignite Mine

Years of Construction Before Operation Begins	Acres of Farmland Lost	Acres Mined Per Year	Acres of Farmland Taken for Urban Use Per In-Migrant	Tons Mined Per Year	KWH Sold	SNG Sold	Mine Value
4	200	660	0.563	6,600,000	0	0	$5,583,6

Project Year	Economic Sector:	4	8	12
		Final Demand Vectors ($000 000)		
1		2.77	0.86	0.69
2		2.82	2.91	1.72
3		1.08	1.99	3.41
4		1.65	4.60	4.90
5		0	2.23	6.94
6		0	2.60	7.38
7		0	2.60	7.10
8-25		0	2.60	7.16

Direct Labor (Man-Years)

roject Year:	1	2	3	4	5-2
onstruction (or Temporary):	125	50	125	50	0
peration (or Permanent):	38	103	145	185	22

Specified by user.

6	1975	38	UPA-CPA Coal Electric Gen and Aaaoc. M Phaae 1

Years of Construction Before Operation Begins	Acres of Farmland Lost	Acres Mined Per Year	Acres of Farmland Taken for Urban Use Per In-Migrant	Tons Mined Per Year	KWH Sold
4	2,986	206.5	0.563	2,800,000	3,250,000,000

Project Year	Economic Sector:	Final Demand Vectora ($000 000) 4	8	12
1		4.24	0.28	2.9
2		12.73	0.85	9.1
3		16.37	1.09	17.2
4		16.98	1.13	25.8
5		9.70	1.82	19.3
6		0.61	1.21	5.0
7		0	2.34	5.8
8-25		0	2.34	5.8

Direct Labor (Man-Years)

Project Year:	1	2	3	4	5	6
Construction (or Temporary):	225	720	1,500	2,250	1,500	50
Operation (or Permanent):	35	110	190	290	393	448

*Specified by user.

1980	14	NGPL 250 MCFD Natural Gas Plant and 14 MTPY Mine

...of ...ion ...e ...on ...s	Acres of Farmland Lost	Acres Mined Per Year	Acres of Farmland Taken for Urban Use Per In-Migrant	Tons Mined Per Year	KWH Sold	SNG Sold	Mine Value
	600	350	0.563	14,000,000	0	91,000,000,000	$11,844,000

Project Year	Economic Sector:	4	8	12
		Final Demand Vectors ($000 000)		
1		1.20	5.61	7.50
2		4.80	22.43	29.98
3		6.83	31.94	42.70
4		7.21	33.74	45.11
5		0.94	13.21	23.40
6		0.26	11.03	21.17
7		0.17	10.08	22.34
8		0	10.08	20.95
9-25		0	10.08	20.06

Direct Labor (Man-Years)

...Year:	1	2	3	4	5	6	7	8	9 ...
...ion (or Temporary):	700	2,800	3,952	4,088	500	106	64		
...n (or Permanent):					893	1,001	1,086	1,075	1,06...

...ed by user.

Sector	Corresponding SIC Group	Empl Rati Mill
1. Livestock and Livestock Products	01-02	
2. Crops and Other Agricultural Products	01-02	
3. Forestry and Fisheries	07-09	
4. Agriculture, Forestry, and Fishery Services	07-09	
5. Iron Ore Mining	101, 106	
6. Copper Ore Mining	102	
7. Other Non-ferrous Metal Ore Mining	103-107 107-109	
8. Coal Mining	11, 12	
9. Crude Petroleum	13	
10. Stone and Clay Mining and Quarrying	141-145, 148, 149	
11. Chemical and Fertilizer Mining	147	
12. New Residential Building Construction	15, 16, 17	
13. New Non-Residential Building Construction	15, 16, 17	

*BLS data is not sufficient for computation of employment-c ratios for Sectors 12-17.

Sector	Corresponding SIC Group	Ratios (Jobs Per Million Dollars o[f] Output)
New Public Utilities Construction	15, 16, 17	---*
New Highway Construction	15, 16, 17	---*
All Other New Construction	15, 16, 17	---*
Maintenance and Repair Construction	15, 16, 17	---*
Guided Missiles and Space Vehicles	1925	---*
Other Ordnance	19 except 1925	---*
Food Products	20	13.10
Tobacco Manufacturing	21	6.58
Fabric, Yarn, and Thread Mills	221-224, 225, 228	22.50
Miscellaneous Textiles and Floor Construction	227, 229	10.31
Hosiery and Knit Goods	225	20.35
Apparel	23 except 239	40.32
Miscellaneous Fabricated Textiles Products	239	20.15
Logging, Sawmills, and Planing Mills	241, 242	31.14

S data is not sufficient for computation of employment-output
ios for Sectors 12-17.

Sector	Corresponding SIC Group	Ratio Mill
28. Millwork, Plywood, and Other Wood Products	243, 244, 249	
29. Household Furniture	251	
30. Other Furniture	25 except 251	
31. Paper Products	26 except 265	
32. Paperboard	265	
33. Publishing	271-274	
34. Printing	275-279	
35. Chemical Products	281, 286, 289	
36. Agricultural Chemicals	287	
37. Plastic Materials and Synthetic Rubber	2821, 2822	
38. Synthetic Fibers	2823, 2824	
39. Drugs	283	
40. Cleaning and Toilet Preparations	284	
41. Paint	285	
42. Petroleum Products	29	
43. Rubber Products	30 except 307	

Sector	Corresponding SIC Group	Ratios (Jobs Pe[r] Million Dollar[s] Output)
4. Plastic Products	307	16.73
5. Leather, Footwear, and Leather Products	31	60.62
6. Glass	321-323	31.25
7. Cement, Clay, and Concrete Products	324, 325, 327	29.21
8. Miscellaneous Stone and Clay Products	326, 328, 329	35.54
9. Blast Furnaces and Basic Steel Products	331	19.28
0. Iron and Steel Foundries and Forgings	332, 3391, 3399	34.48
1. Primary Copper Metals	3331	4.26
2. Primary Aluminum	3334	5.96
3. Other Primary and Secondary Non-Ferrous Metal	3332, 3333, 3339, 334	5.99
4. Copper Rolling and Drawing	3351	13.89
5. Aluminum Rolling and Drawing	3352	14.26
6. Other Non-Ferrous Rolling and Drawing	3356, 3357	18.22
7. Miscellaneous Non-Ferrous Metal Products	336, 3392	42.67

Sector	Corresponding SIC Group	Ratios (Million Out
58. Metal Containers	341, 3491	16
59. Heating Apparatus and Plumbing Fixtures	343	24
60. Fabricated Structural Metal	344	30
61. Screw Machine Products	345, 346	47
62. Other Fabricated Metal Products	342, 347-349 except 3491	27
63. Engines, Turbines, and Generators	351	13
64. Farm Machinery	352	19
65. Construction, Mining, and Oilfield Machinery	3531-3533	25
66. Material Handling Equipment	3534-3537	22
67. Metalworking Machinery	354	34
68. Special Industry Machinery	355	26
69. General Industrial Machinery	356	21
70. Machine Shop Products	359	56
71. Computers and Peripheral Equipment	3573-3574	21

Sector	Corresponding SIC Group	Ratios (. Million I Out
72. Typewriters and Other Office Machines	357 except 3573, 3574	22
73. Service Industry Machines	358	10
74. Electric Transmission Equipment	361	29
75. Electrical Industrial Apparatus	362	27
76. Household Appliances	363	15
77. Electric Lighting and Wiring	364	29
78. Radio and Television Sets	365	7
79. Telephone and Telegraph Apparatus	3661	21
80. Other Electronic Communication Equipment	3662	19
81. Electronic Components	367	18
82. Other Electrical Machinery	369	19
83. Motor Vehicles	371	9
84. Aircraft	372	25
85. Ship and Boat Building and Repair	373	35
86. Railroad and Other Transportation Equipment	374-375	12

	Sector	Corresponding SIC Group	Millio O
87.	Miscellaneous Transportation Equipment	379	
88.	Scientific and Controlling Instruments	381, 382, 387	
89.	Medical and Dental Instruments	384	
90.	Optical and Ophthalmic Equipment	383, 385	
91.	Photographic Equipment and Supplies	386	
92.	Miscellaneous Manufactures Products	39	
93.	Railroad Transportation	40, 474	
94.	Local Transit and Intercity Bus	41	
95.	Truck Transportation	42, 473	
96.	Water Transportation	44	
97.	Air Transportation	45	
98.	Other Transportation	46, 47 except 473, 474	
99.	Communications, except Radio, TV	48 except 483	
100.	Radio and TV Broadcasting	483	

	Sector	Corresponding SIC Group	Employment-Output Ratios (Jobs Per Million Dollars Output)
01.	Electric Utilities	491, part 493	11.80
02.	Gas Utilities	492, part 493	9.33
03.	Water and Sanitary Services	494-497, part 493	18.77
04.	Wholesale Trade	50	40.28
05.	Retail Trade	52-59	103.39
06.	Finance	60-62, 67	55.47
07.	Insurance	63, 64	46.39
08.	Owner-Occupied Dwellings	SIC not comparable	NA
09.	Other Real Estate	65, 66	12.06
10.	Hotels and Lodging Places	70	196.83
11.	Other Personal Services	72, 76	126.74
12.	Miscellaneous Business Services	73 except 731	83.81
13.	Advertising	731	7.42
14.	Miscellaneous Professional	81, 89 except 892	61.64
15.	Automobile Repair	75	34.01
16.	Motion Pictures	78	56.87

	Sector	Corresponding SIC Group	Million Do Outpu
117.	Other Amusements	79	100.3
118.	Health Services except Hospitals	80 except 806	97.
119.	Hospitals	806	124.3
120.	Educational Services	82	126.7
121.	Non-Profit Organizations	84, 86, 892	130.4
122.	Post Office	4311	82.8
123.	Commodity Credit Corporation	SIC not comparable	NA
124.	Other Federal Enterprises	SIC not comparable	39.3
125.	State and Local Government Enterprises	SIC not comparable	51.9
126.	Directly Allocated Imports	Dummy Sectors	NA
127.	Transferred Imports	Dummy Sectors	NA
128.	Business Travel, Entertainment, and Gifts	Dummy Sectors	NA
129.	Office Supplies	Dummy Sectors	NA

or e	Absolute Number	Title	1967 SIC
		AGRILCULTURE, FORESTRY & FISHERIES	
0	1	Fruit & Vegetable Products	0122, 0123
2	2	Dairy Products	0132
3	3	Poultry Products	0133, 0134
0	4	Other Agricultural Products	011, 0135, 01 019, 0729 pt,
8	5	Agricultural, Forestry, & Fishery Services	071, 0723, 07 085, 098
9	6	Forestry & Fishery Products	074, 081, 082 086, 091
		MINING	
1	7	Dimension Stone	1411
1	8	Crushed & Broken Stone	142
1	9	Sand & Gravel	144
0	10	Mining, not elsewhere classified	145, 148, 149
		CONSTRUCTION	
9	11	Maintenance & Repair Construction Allocator	(NA)
1	12	General Contractors	1511
1	13	Highway & Street Construction	1611
1	14	Heavy Construction	1621
1	15	Special Trade Contractors, not elsewhere classified	172, 174, 175 177, 178, 179
1	16	Plumbing, Heating, & Air-Conditioning Contractors	1711
1	17	Electrical Contractors	1731

TABLE C-8 (continued)

Sector Code	Absolute Number	Title	1967 SIC
		MANUFACTURING	
1900	18	Ordnance & Accessories	19
2011	19	Meat-Packing Plants	2011
2013	20	Sausage & Other Prepared Meat Products	2013
2015	21	Poultry & Small Game Dressing & Packing	2015
2020	22	Creamery Butter & Natural Cheese	2021,
2024	23	Ice Cream & Frozen Desserts	2024
2026	24	Fluid Milk	2026
2031	25	Canned & Cured Sea Foods	2031
2032	26	Canned Specialties	2032
2033	27	Canned Fruits, Vegetables, Preserves, Jams & Jellies	2033
2034	28	Dried & Dehydrated Fruit & Vegetables	2034
2035	29	Pickled Fruits & Vegetables	2035
2036	30	Fresh or Frozen Packaged Fish	2036
2037	31	Frozen Fruits, Fruit Juices, Vegetables & Specialties	2037
2041	32	Flour & Other Grain Mill Products	2041
2042	33	Prepared Feeds for Animals & Fowls	2042
2043	34	Cereal Preparations	2043
2045	35	Blended & Prepared Flour	2045
2046	36	Wet Corn Milling	2046
2051	37	Bread & Other Bakery Products	2051
2052	38	Biscuit, Crackers & Pretzels	2052
2062	39	Cane Sugar Refining	2062
2071	40	Candy & Other Confectionery	2071
2072	41	Chocolate & Cocoa Products	2072

Sector Code	Absolute Number	Title	1967 SIC
		MANUFACTURING (Continued)	
2084	44	Wines, Brandy & Brandy Spirits	2084
2085	45	Distilled, Rectified, & Blended Liquors	2085
2086	46	Bottled & Canned Soft Drinks & Carbonated Waters	2086
2087	47	Flavoring Extractions & Flavoring Syrups	2087
2090	48	Food Preparations, not elsewhere classified	2025, 2099
2094	49	Animal & Marine Fats & Oils	2094
2095	50	Roasted Coffee	2095
2096	51	Shortening, Table Oils, Margarine	2096
2097	52	Manufactured Ice	2097
2111	53	Cigarettes	2111
2121	54	Cigars	2121
2131	55	Tobacco & Snuff	2131
2211	56	Broad Woven Fabric Mills, Cotton	2211
2221	57	Broad Woven Fabric Mills, Man-Made Fiber & Silk	2221
2231	58	Broad Woven Fabric Mills, Wool	2231
2241	59	Narrow Fabrics & Other Smallwares Mills	2241
2251	60	Women's Full-Length & Knee-Length Hosiery Mills	2251
2252	61	Other Hosiery Mills	2252
2253	62	Knit Outerwear Mills	2253
2254	63	Knit Underwear Mills	2254
2256	64	Knit Fabric Mills	2256
2259	65	Knitting Mills, not elsewhere classified	2259
2261	66	Finishers of Broad Woven Fabrics of Cotton	2261

TABLE C-8 (continued)

bsolute Number	Title	1967 SIC
	MANUFACTURING (Continued)	
67	Finishers of Broad Woven Fabrics of Man-Made Fiber & Silk	2262
68	Dying & Finishing Textiles, not elsewhere classified	2269
69	Woven Carpets & Rugs	2271
70	Tufted Carpets & Rugs	2272
71	Carpets, Rugs, & Mats, not elsewhere classified	2279
72	Yarn Spinning Mills	2281
73	Yarn Throwing, Twisting, & Winding Mills	2282
74	Yarn Mills, Wool, Including Carpet & Rug Yarn	2283
75	Thread Mills	2284
76	Felt Goods, Excluding Woven Felts & Hats	2291
77	Lace Goods	2292
78	Padding & Upholstery Filling	2293
79	Processed Waste & Recovered Fibers & Flock	2294
80	Artificial Leather, Oilcloth, etc.	2295
81	Wool Scouring, Worsted Combing, & Tow-to-Top Mills	2297
82	Cordage & Twine	2298
83	Textile Goods, not elsewhere classified	2299
84	Men's, Youths', & Boys' Suits, Coats, & Overcoats	2311
85	Men's, Youths', & Boys' Shirts, Collars, Nightwear	2321
86	Men's, Youths', & Boys' Underwear	2322

:or le	Absolute Number	Title	1967 SIC
		MANUFACTURING (Continued)	
28	89	Work Clothing	2328
29	90	Men's, Youths' & Boys' Clothing not elsewhere classified	2329
31	91	Blouses, Waists, & Shirts	2331
35	92	Dresses	2335
37	93	Suits, Shirts & Coats, Excluding Fur Coats & Raincoats	2337
39	94	Women's, Misses', & Juniors' Outerwear, not elsewhere classified	2339
41	95	Women's, Misses', Children's & Infants' Underwear	2341
42	96	Corsets & Allied Garments	2342
51	97	Millinery	2351
52	98	Men's & Boys' Hats & Caps	2352
51	99	Dresses, Blouses, Waists, & Shirts	2361
53	100	Coats & Suits	2363
59	101	Girls', Children's & Infants' Outerwear, not elsewhere classified	2369
71	102	Fur Goods	2371
31	103	Dresses & Work Gloves, Excluding Knit & All Leather	2381
34	104	Robes & Dressing Gowns	2384
35	105	Raincoats & Other Waterproof Outer Garments	2385
36	106	Leather & Sheep-Lined Clothing	2386
37	107	Apparel Belts	2387
39	108	Apparel, not elsewhere classified	2389
91	109	Curtains & Draperies	2391
92	110	Housefurnishings, Excluding Curtains & Draperies	2392
92	111	Textile Bags	2393
94	112	Canvas Products	2394

TABLE C-8 (continued)

bsolute Number	Title	1967 SIC
	MANUFACTURING (Continued)	
113	Pleating, Decorative & Novelty Stitching & Tucking	2395
114	Apparel Findings & Related Products	2396
115	Schiffli Machine Embroideries	2397
116	Fabricated Textile Products, not elsewhere classified	2399
117	Sawmills & Planing Mills, General	2421
118	Millwork Plants	2431
119	Prefabricated Wooden Buildings & Structural Members	2433
120	Nailed & Lock Corner Wooden Boxes & Shook	2441
121	Veneer & Plywood Containers, Excluding Boxes & Crates	
122	Cooperage	
123	Wood Products, not elsewhere classified	2411, 2426, 2429, 2432, 2442, 2491, 2499
124	Wood Household Furniture, Excluding Upholstered	2511
125	Wood Household Furniture, Upholstered	2512
126	Metal Household Furniture	2514
127	Mattresses & Bedsprings	2515
128	Household Furniture, not elsewhere classified	2519
129	Wood Office Furniture	2521

Number	Title	SIC
	MANUFACTURING (Continued)	
133	Metal Partitions, Shelving, Lockers & Office & Store Fixtures	2542
134	Venetian Blinds & Shades	2591
135	Furniture & Fixtures, not elsewhere classified	2599
136	Paper Mills, Excluding Building Paper Mills	2621
137	Paperboard Mills	2631
138	Converted Paper & Paperboard Products, not elsewhere classified	2644, 2646, 2649
139	Paper Coating & Glazing	2641
140	Envelopes	2642
141	Bags, Excluding Textile Bags	2643
142	Die Cut Paper & Paperboard; & Cardboard	2645
143	Sanitary Paper Products	2647
144	Folding Paperboard Boxes	2651
145	Set-Up Paperboard Boxes	2652
146	Corrugated & Solid Fiber Boxes	2653
147	Sanitary Food Containers	2654
148	Fiber Cans, Tubes, Drums, & Similar Products	2655
149	Building Paper & Building Board Mills	2661
150	Newspapers: Publishing, Publishing & Printing	2711
151	Periodicals: Publishing, Publishing & Printing	2721
152	Books: Publishing, Publishing & Printing	2731
153	Book Printing	2732
154	Miscellaneous Publishing	2741
155	Commercial Printing, Excluding Lithographic	2751

TABLE C-8 (continued)

Sector Code	Absolute Number	Title	1967 SIC
		MANUFACTURING (Continued)	
2752	156	Commercial Printing, Lithographic	2752
2753	157	Engraving & Plate Printing	2753
2761	158	Manifold Business Forms Manufacturing	2761
2771	159	Greeting Card Manufacturing	2771
2782	160	Blankbooks, Loose-Leaf Binders & Devices	2782
2789	161	Bookbinding & Miscellaneous Related Work	2789
2791	162	Typesetting	2791
2793	163	Photoengraving	2793
2794	164	Electrotyping & Stereotyping	2794
2799	165	Service Industries for the Printing Trades, not elsewhere classified	2799
2813	166	Industrial Gases	2813
2815	167	Cyclic Intermediates, Dyes, Organic Pigments and Cyclic Crudes	2815
2816	168	Inorganic Pigments	2816
2818	169	Industrial Organic Chemicals, not elsewhere classified	2818
2819	170	Industrial Inorganic Chemicals, not elsewhere classified	2819
2821	171	Plastics Materials, Synthetic Resins & Nonvulcanizable Elastomers	2821
2830	172	Drugs	283
2841	173	Soap & Other Detergents	2841
2842	174	Specialty Cleaning, Polishing & Sanitation	

e	Number	Title	SIC
		MANUFACTURING (Continued)	
1	177	Paints, Varnishes, Lacquers, Enamels, & Allied Products	2851
1	178	Gum & Wood Chemicals	2861
0	179	Agricultural Chemicals	2879, 2873, 2[illegible]
1	180	Fertilizers	2871
1	181	Adhesives & Gelatin	2891
2	182	Explosives	2892
3	183	Printing Ink	2893
5	184	Carbon Black	
9	185	Chemicals & Chemical Preparations, not elsewhere classified	2899
1	186	Petroleum Refining	2911
1	187	Paving & Mixture & Blocks	2951
2	188	Asphalt Felts & Coatings	2952
2	189	Lubricating Oils & Greases	2992
1	190	Tires & Inner Tubes	3011
1	191	Rubber Footwear	3021
1	192	Reclaimed Rubber	3031
9	193	Fabricated Rubber Products, not elsewhere classified	3069
9	194	Miscellaneous Plastic Products	3079
1	195	Leather Tanning & Finishing	3111
1	196	Industrial Leather Belting & Packing	3121
1	197	Boot & Shoe Cut Stock & Findings	3131
1	198	Footwear, Excluding House Slippers	3141

TABLE C-8 (continued)

Sector Code	Absolute Number	Title	1967 SIC
		MANUFACTURINC (Continued)	
3142	199	House Slippers	3142
3161	200	Luggage	3161
3171	201	Women's Handbags & Purses	3171
3172	202	Personal Leather Goods, Excluding Handbags & Purses	3172
3199	203	Leather Goods, not elsewhere classified	3199
3211	204	Flat Glass	3211
3221	205	Class Containers	3221
3229	206	Pressed & Blown Glass Glassware, not elsewhere classified	3229
3231	207	Glass Products Made of Purchased Glass	3231
3241	208	Cement, Hydraulic	3241
3251	209	Brick & Structural Clay Tile	3251
3253	210	Ceramic Wall & Floor Tile	3253
3255	211	Clay Refractories	3255
3259	212	Structural Clay Products, not elsewhere classified	3259
3261	213	Vitreous China Plumbing Fixtures	3261
3269	214	Pottery Products, not elsewhere classified	3269
3271	215	Concrete Brick & Block	3271
3272	216	Concrete Products, Excluding Block & Brick	3272
3273	217	Ready-Mixed Cement	3273

Sector Code	Absolute Number	Title	19 S
		MANUFACTURING (Continued)	
3293	223	Steam & Other Packing & Pipe & Boiler Covering	32
3295	224	Minerals & Earths	32
3296	225	Mineral Wool	32
3297	226	Nonclay Refractories	32
3299	227	Nonmetallic Mineral Products, not elsewhere classified	32
3312	228	Blast Furnaces, Steel Works, & Rolling Mills	33
3315	229	Steel Wire Drawing & Steel Nails & Spikes	33
3316	230	Cold Rolled Sheet, Strip & Bars	33
3317	231	Steel Pipe & Tubes	33
3321	232	Gray Iron Foundries	33
3323	233	Steel Iron Foundries	33
3330	234	Primary Smelting & Refining of Nonferrous Metals	33
3333	235	Primary Smelting & Refining of Zinc	33
3334	236	Primary Production of Aluminum	33
3341	237	Secondary Smelting Refining & Alloying of Nonferrous Metals	33
3351	238	Rolling, Drawing & Extruding of Copper	33
3352	239	Rolling, Drawing & Extruding of Aluminum	33
3356	240	Rolling, Drawing & Extruding of Other Nonferrous Metals	33
3357	241	Drawing & Insulating of Nonferrous Wire	33
3361	242	Aluminum Castings	33
3362	243	Brass, Bronze, Copper, Copper Base Alloy Castings	33
3369	244	Nonferrous Casting, not elsewhere classified	33

TABLE C-8 (continued)

ctor ode	Absolute Number	Title	1967 SIC
		MANUFACTURING (Continued)	
390	245	Primary Metal Products, not elsewhere classified	3392, 3399
391	246	Iron & Steel Forgings	3391
411	247	Metal Cans	3411
421	248	Cutlery	3421
423	249	Hand & Edge Tools, Excluding Machine Tools & Saws	3423
425	250	Hand Saws & Saw Blades	3425
429	251	Hardware, not elsewhere classified	3429
431	252	Enameled Iron & Metal Sanitary Ware	3431
432	253	Plumbing Fixture Fittings & Trim	3432
433	254	Heating Equipment, Excluding Electric	3433
441	255	Fabricated Structural Steel	3441
442	256	Metal Doors, Sash, Frames, Molding & Trims	3442
443	257	Fabricated Plate Work (Boiler Shops)	3443
444	258	Sheet Metal Work	3444
449	259	Architectural & Miscellaneous Metal Work	3446, 3449
451	260	Screw Machine Products	3451
452	261	Bolts, Nuts, Screws, Rivets & Washers	3452
461	262	Metal Stampings	3461
471	263	Electroplating, Plating, Polishing, Anodizing & Coloring	3471
479	264	Coating, Engraving, & Allied Services, not elsewhere classified	3479
481	265	Miscellaneous Fabricated Wire Products	3481
491	266	Metal Shipping Barrels, Drums, Kegs & Pails	3491

TABLE C-8 (continued)

bsolute Number	Title	1967 SIC
	MANUFACTURING (Continued)	
269	Collapsible Tubes	3496
270	Metal Foil & Leaf	3497
271	Fabricated Pipe & Fabricated Pipe Fittings	3498
272	Fabricated Metal Products, not elsewhere classified	3499
273	Steam Engines; Steam, Cas, & Hydraulic Turbines; and Steam, Gas, & Hydraulic Turbine Generator Set Units & Other Internal Combustion Engines, not elsewhere classified	3511, 3519
274	Farm Machinery & Equipment	3522
275	Construction Machinery & Equipment	3531
276	Elevators & Moving Stairways	3534
277	Conveyors & Conveying Equipment	3535
278	Hoist, Industrial Cranes & Monorail Systems	3536
279	Industrial Trucks, Tractors, Trailers & Stackers	3537
280	Machine Tools, Metal-Cutting Types	3541
281	Machine Tools, Metal-Forming Types	3542
282	Special Dies & Tools, Die Sets, Jigs & Fixtures	3544
283	Machine Tool Accessories & Measuring Devices	3545
284	Metal-Working Machinery, Excluding Machine Tools	3548
285	Food Products Machinery	3551
286	Textile Machinery	3552
287	Woodworking Machinery	3553
288	Paper Industries Machinery	3554
289	Printing Trades Machinery & Equipment	3555

TABLE C-8 (continued)

...or ...e	Absolute Number	Title	1967 SIC
		MANUFACTURING (Continued)	
...9	290	Special Industry Machinery, not elsewhere classified	3559
...1	291	Pumps, Air & Gas Compressors & Pumping Equipment	3561
...2	292	Ball & Roller Bearings	3562
...4	294	Blowers Exhaust & Ventilating Fans	3564
...5	294	Industrial Patterns	3565
...6	295	Mechanical Power Transmission Equipment, Excluding Ball and Roller Bearings	3566
...7	296	Industrial Process Furnaces & Ovens	3567
...9	297	General Industrial Machinery & Equipment, not elsewhere classified	3569
...3	298	Electronic Computing Equipment	3573
...6	299	Scales & Balances, Excluding Laboratory	3576
...9	300	Office Machines, not elsewhere classified	3579
...1	301	Automatic Merchandising Machines	3581
...2	302	Commercial Laundry, Dry Cleaning, & Processing Machines	3582
...5	303	Refrigerators, Refrigeration Machinery, Excluding Household, & Complete Air-Conditioning Units	3585
...6	304	Measuring & Dispensing Pumps	3586
...9	305	Service Industry Machines, not elsewhere classified	3589
...9	306	Miscellaneous Machinery, Except Electrical	3599, 3532, 3...
...1	307	Electrical Measuring [illegible] & Test Equi[illegible]	[illegible]

Sector Code	Absolute Number	Title	1967 SIC
		MANUFACTURING (Continued)	
3621	310	Motors & Generators	3621
3622	311	Industrial Controls	3622
3623	312	Welding Apparatus	3623
3624	313	Carbon & Graphite Products	3624
3629	314	Electrical Industrial Apparatus, not elsewhere classified	3629
3631	315	Household Cooking Equipment	3631
3633	316	Household Laundry Equipment	3633
3634	317	Electric Housewares & Fans	3634
3635	318	Household Vacuum Cleaners	3635
3639	319	Household Appliances, not elsewhere classified	3639
3642	320	Lighting Fixtures	3642
3643	321	Current-Carrying Wiring Devices	3643
3644	322	Noncurrent-Carrying Wiring Devices	3644
3651	323	Radio & T.V. Receiving Sets, Excluding Communication Types	3651
3652	324	Phonograph Records	3652
3661	325	Telephone & Telegraph Apparatus	3661
3662	326	Radio & T.V. Transmitting, Signaling & Detection Equipment & Apparatus	3662
3672	327	Cathode Ray Picture Tubes	3672
3673	328	Transmitting Industrial & Special Purpose Electron Tubes	3673
3674	329	Semiconductors & Related Devices	3674
3679	330	Electronic Components & Accessories, not elsewhere classified	3679
3690	331	Electrical Machinery Equipment & Supplies, not elsewhere classified	3699,
3691	332	Storage Batteries	3691

TABLE C-8 (continued)

tor de	Absolute Number	Title	1967 SIC
		MANUFACTURING (Continued)	
93	333	X-Ray Apparatus and Tubes	3693
94	334	Engine Electrical Equipment	3694
11	335	Motor Vehicles	3711
13	336	Truck & Bus Bodies	3713
14	337	Motor Vehicle Parts & Accessories	3714
15	338	Truck Trailers	3715
21	339	Aircraft	3721
22	340	Aircraft Engines & Engine Parts	3722
29	341	Aircraft Parts, Equipment, not elsewhere classified	3729
31	342	Ship Building & Repairing	3731
32	343	Boat Building & Repairing	3732
42	344	Railroad & Street Cars	3742
91	345	Trailer Coaches	3791
99	346	Transportation Equipment, not elsewhere classified	3799
11	347	Engineering, Laboratory, & Scientific & Research Instruments & Associated Equipment	3811
21	348	Mechanical Measuring & Controlling Instruments	3821
22	349	Automatic Temperature Controls	3822
31	350	Optical Instruments & Lenses	3831
41	351	Surgical & Medical Instruments & Apparatus	3841
42	352	Orthopedic, Prosthetic & Surgical Appliances	3842
43	353	Dental Equipment & Supplies	3843
61	354	Photographic Equipment & Supplies	3861

TABLE C-8 (continued)

ctor ode	Absolute Number	Title	1967 SIC
		MANUFACTURING (Continued)	
913	356	Lapidary Work & Cutting & Polishing Diamonds	3913
914	357	Silverware & Plated Ware	3914
931	358	Musical Instruments & Parts	3931
941	359	Games & Toys	3941
942	360	Dolls	3942
949	361	Children's Vehicles, Excluding Bicycles	3949
951	362	Pens, Pen Points, Fountain Pens, Ball Point Pens, Mechanical Pencils & Parts	3951
952	363	Lead Pencils, Crayons, Artists' Materials	3952
953	364	Marketing Devices	3953
955	365	Carbon Paper & Inked Ribbons	3955
961	366	Costume Jewelry & Costume Novelties, Excluding Precious Metals	3961
962	367	Feathers, Plumes, & Artificial Flowers	3962
964	368	Needles, Pins, Hooks & Eyes, & Similar Notions	3964
991	369	Brooms & Brushes	3991
993	370	Signs & Advertising Displays	3993
994	371	Morticians' Goods	3994
996	372	Linoleum, Asphalted-Felt-Base, and Other Floor Coverings	3996
999	373	Manufacturing Industries, not elsewhere classified	3999, 3851, 3963, 3943
		TRANSPORTATION, COMMUNICATIONS, ELECTRIC, GAS AND SANITARY SERVICES	
011	374	Railroads	4011, 4013

TABLE C-8 (continued)

Sector Code	Absolute Number	Title	1967 SIC
		TRANSPORTATION, COMMUNICATIONS, ELECTRIC, GAS AND SANITARY SERVICES (continued)	
4150	377	Transportation Services, not elsewhere classified	4020, 413, 4231,
4210	378	Trucking, Local & Long Distance	421
4220	379	Public Warehousing	422
4400	380	Water Transportation	44
4500	381	Air Transportation	45
Communications			
4811	382	Telephone Communication	4811
4832	383	Radio Broadcasting	4832
4833	384	Television Broadcasting	4833
4890	385	Communication Services, not elsewhere classified	4821,
Utilities			
4911	386	Electric Companies & Systems	4961,
4920	387	Gas Companies & Systems	492 &
4941	388	Water Supply	4941
4990	489	Sanitary & Other Utility Systems, not elsewhere classified	4939,

Absolute Number	Title	1967 SIC
	WHOLESALE TRADE (continued)	
394	Paints & Varnishes	5028
395	Chemicals & Allied Products, not elsewhere classified	5029
396	Ory Goods, Piece Goods, & Notions	5033, 5034
397	Apparel & Accessories, Hoisery & Lingerie	5036, 5037
398	Footwear	5039
399	Groceries, General Line	5041
400	Dairy Products	5043
401	Poultry & Poultry Products	5044
402	Confectionery	5045
403	Fish & Sea Foods	5046
404	Meats & Meat Products	5047
405	Fresh Fruits & Vegetables	5048
406	Groceries & Related Products, not elsewhere classified	5049, 5042
407	Farm Products, Raw Materials	505
408	Electrical Apparatus & Equipment, Wiring Supplies, & Construction Materials	5063
409	Electrical Appliances, TV & Radio Sets	5064
410	Electrical Parts & Equipment	5065
411	Hardward	5072
412	Plumbing & Heating Equipment & Supplies	5074
413	Air-Conditioning & Refrigeration Equipment & Supplies	5077
414	Commercial & Industrial Machinery, Equipment, & Supplies	5082
415	Farm Machinery & Equipment	5083
416	Professional Equipment & Supplies	5086
417	Equipment & Supplies for Service Establishments	5087

TABLE C-8 (continued)

Sector Code	Absolute Number	Title	1967 SIC
		WHOLESALE TRADE (continued)	
5089	418	Machinery, Equipment, & Supplies, not elsewhere classified	5088,
5091	419	Metals & Minerals, Excluding Petroleum & Scrap	5091
5092	420	Petroleum & Petroleum Products	5092
5093	421	Scrap & Waste Materials	5093
5099	422	Miscellaneous Wholesalers, not elsewhere classified	5094, 5097,
		RETAIL TRADE	
5210	423	Lumber & Other Building Materials Dealers	5211
5221	424	Plumbing, Heating, & Air-Conditioning Equipment Dealers	5221
5231	425	Paint, Glass, & Wallpaper Stores	5231
5241	426	Electrical Supply Stores	5241
5250	427	Hardware Stores & Farm Equipment Dealers	525
5311	428	Department Stores	5311
5331	429	Variety Stores	5331
5342	430	Mail Order Houses & Merchandise Vending Machine Operators	5341
5351	431	Direct Selling Organizations	5351
5399	432	Miscellaneous General Merchandise Stores	5399

Absolute Number	Title	1967 SIC
	RETAIL TRADE (continued)	
436	Candy, Nut, & Confectionery Stores	5441
437	Retail Bakeries	546
438	Miscellaneous Food Stores, not elsewhere classified	5451, 5499
439	Motor Vehicle Dealers	5511
440	Motor Vehicle Dealers, (used cars only)	5521
441	Tire, Battery, & Accessory Dealers	5531
442	Gasoline Service Stations	5541
443	Miscellaneous Aircraft, Marine & Automotive Dealers	559
444	Men's & Boys' Clothing & Furnishings Stores	5611
445	Women's Ready-to-Wear Stores	5621
446	Women's Accessory & Specialty Stores	5631
447	Children's & Infants' Wear Stores	5641
448	Family Clothing Stores	5651
449	Shoe Stores	5661
450	Miscellaneous Apparel & Accessory Stores, not elsewhere classified	5671, 5681, 56
451	Furniture, Home Furnishings, & Equipment Stores	571
452	Household Appliance Stores	5722
453	Radio, Television, & Music Stores	573
454	Eating Places	5812
455	Drinking Places	5813

TABLE C-8 (continued)

ctor ode	Absolute Number	Title	1967 SIC
		RETAIL TRADE (continued)	
912	456	Drug Stores & Proprietary Stores	5912
921	457	Liquor Stores	5921
940	458	Book & Stationery Stores	594
950	459	Sporting Goods Stores & Bicycle Shops	595
971	460	Jewelry Stores	5971
980	461	Fuel & Ice Dealers	598
990	462	Retail Stores, not elsewhere classified	593, 596, 59
		FINANCE, INSURANCE, AND REAL ESTATE	
011	463	Federal Reserve Bank	6011
020	464	Commercial & Stock Savings Banks	602
030	465	Mutual Savings Banks	603
120	466	Savings & Loan Associations	612
190	467	Miscellaneous Financial Institutions	604, 605, 61 614, 615, 61
200	468	Security & Commodity Brokers, Dealers, Exchanges, & Services	62
301	469	Non-Life Insurance Carriers	632 pt, 633, 636, 639
310	470	Life Insurance Carriers	631, 632 pt

Absolute Number	Title	1967 SIC
	SERVICES	
473	Hotel, Personal, & Repair Services	70, 72, 76 (exc 7694, 7699)
474	Business Services, Excluding Advertising	6541, 73 (exc. 7391) 7694, 769 81, 89 (exc. 89
475	Advertising Services	731
476	Research & Development, Educational & Scientific Research Agencies	7391, 8921
477	Automobile Repair, Services & Garages	75
478	Amusement & Recreational Services	78, 79
	MEDICAL, EDUCATIONAL, NON-PROFIT	
479	Hospitals	8061
480	Medical & Health Services, not elsewhere classified	80 (exc. 8061), 0722
481	Elementary & Secondary Schools	8211
482	Institutions of Higher Education	822

TABLE C-8 (continued)

...tor ...le	Absolute Number	Title	1967 SIC
		MEDICAL, EDUCATIONAL, NON-PROFIT (continued)	
...0	483	Other Educational Services, not elsewhere classified	823, 824, 829
...6	484	Non-Profit Membership Organizations, Museums, Art Galleries, Botanical & Zoological Gardens	84, 86
...0	485	Private Household Services	88
		GOVERNMENT, HOUSEHOLDS, & MISCELLANEOUS	
...0	486	Local Government, Excluding Water Utilities and Education	93
...6	487	Office Supplies Allocator	(NA)
...2	488	Transportation Services Allocator	(NA)
...8	489	Households	(NA)
...9	490	Nonclassifiable Industries	9999
SECTORS WHICH APPEAR ONLY AS ROWS, NOT AS COLUMNS			
...11	491	Iron Ores	1011
...21	492	Copper Ores	1021

.of de	Absolute Number	Title	SIC
		GOVERNMENT, HOUSEHOLDS, & MISCELLANEOUS (continued)	
)93	497	Titanium Ores	1093
)99	498	Metal Ores, not elsewhere classified	1099
100	499	Anthracite Mining	1100
311	500	Crude Petroleum and Natural Gas	1311
453	501	Fire Clay	1453
455	502	Kaolin and Ball Clay	1455
459	503	Clay and Related Materials, not elsewhere classified	1459
470	504	Chemical and Fertilizer Minerals	1470
)23	505	Condensed and Evaporated Milk	2023
)44	506	Rice Milling	2044
)61	507	Raw Cane Sugar	2061
)83	508	Malt	2083
)91	509	Cottonseed Oil Mills	2091
)92	510	Soybean Oil Mills	2092
141	511	Tobacco Stemming and Redrying	2141
296	512	Tire Cord and Fabric	2296

TABLE C-8 (continued)

Sector Code	Absolute Number	Title	1967 SIC
		GOVERNMENT, HOUSEHOLDS, & MISCELLANEOUS (continued)	
* 2442	513	Wirebound Boxes and Crates	2442
* 2611	514	Pulp Mills	2611
* 2812	515	Alkalies and Chlorine	2812
* 2822	516	Synthetic Rubber	2822
* 2823	517	Cellulose Man-Made Fibers	2823
* 2824	518	Synthetic Organic Fibers	2824
* 2833	519	Medicinals and Botanicals	2833
* 2999	520	Petroleum and Coal Products, not elsewhere classified	2999
* 3151	521	Leather Gloves and Mittens	3151
* 3262	522	Vitreous Table and Kitchenware	3262
* 3263	523	Fine Eartherware Food Utensils	3263
* 3264	524	Porcelain Electrical Supplies	3264
* 3313	525	Electrometallurgical Products	3313

ode	Number	Title	SIC
		COVERNMENT, HOUSEHOLDS, & MISCELLANEOUS (continued)	
3572	528	Typewriters	3572
3584	529	Industrial Vacuum Cleaners	part 3589
3632	530	Household Refrigerators and Freezers	3632
3636	531	Sewing Machines	3636
3641	532	Electric Lamps	3641
3671	533	Electron Tubes, Receiving Type	3671
3692	534	Primary Batteries, Dry and Wet	3692
3723	535	Aircraft Propellers and Parts	3723
3741	536	Locomotives and Parts	3741
3751	537	Motocycles, Bicycles and Parts	3751
3851	538	Opthalmic Goods	3851
3871	539	Watches, Clocks and Watchcases	3871
3943	540	Childrens' Vehicles, Excluding Bicycles	3943
6510	541	Real Estate Operators and Lessors	6510
9100	542	Federal Taxes	(NA)
9102	543	U.S. Post Office	(NA)

TABLE C-8 (continued)

tor de	Absolute Number	Title	1967 SIC
		GOVERNMENT, HOUSEHOLDS, & MISCELLANEOUS (continued)	
200	544	State Taxes	(NA)
522	545	Scrap Textile Products	(NA)
524	546	Scrap Lumber Products	(NA)
526	547	Scrap Paper Products	(NA)
530	548	Scrap Rubber Products	(NA)
533	549	Scrap Ferrous Metal Products	(NA)
534	550	Scrap Nonferrous Metal Products	(NA)
538	551	Scrap Steel Drums	(NA)
891	552	Net Profit	(NA)
892	553	Capital Allowance	(NA)
893	554	Employee Fringe Benefits	(NA)

The 90-order aggregate sector number, for investment and employme
follows the sector title. The 4-digit SIC codes are those used fo
1967 census of manufactures. A code ending with a '0' designates
entire 3-digit group; a code ending with '00' designates an entir
2-digit group. A minus sign indicates that this SIC is excluded f
the sector.

	Sector Titles	90-Order	Standard Industrial Classifica				
1	Dairy farm products	(1)	132				
2	Poultry and eggs	(1)	133				
3	Meat animals, oth livestk	(1)	135	136	139	193	
4	Cotton	(1)	112				
5	Grains	(1)	113				
6	Tobacco	(1)	114				
7	Fruit, vegetbs, oth crops	(1)	119	120	192		
8	Forestry	(1)	810	820	840	860	9
9	Fishery products	(1)	074				
10	Agr, forestry & fish serv.	(1)	710	720	730	850	9
11	Iron ores	(2)	1010	1060			
12	Copper ore	(2)	1020				
13	Other non-ferrous ores	(2)	1030	1050	1090		
14	Coal mining	(2)	1110	1210			
15	Crude petrolum, nat. gas	(3)	1310	1320			
16	Empty						
17	Stone and clay mining	(2)	1410	1420	1440	1450	14
18	Chemical fertilizer mining	(2)	1470				
19	New construction	(4)	1600				
20	Maintenance construction	(0)	1500				
21	Complete guided missiles	(5)	1925				
22	Ammunition	(5)	1929	1960			
23	Other ordnance	(5)	1910	1930	1940	1950	19
24	Meat products	(6)	2010				
25	Dairy products	(7)	2020				
26	Canned and frozen foods	(8)	2030				
27	Grain mill products	(9)	2040				
28	Bakery products	(10)	2050				
29	Sugar	(11)	2060				
30	Confectionery products	(12)	2070				
31	Alcoholic beverages	(13)	2082	2083	2084	2085	
32	Soft drinks and flavorings	(13)	2086	2087			
33	Fats and oils	(14)	2091	2092	2093	2094	20

Tobscco products	(15)	2110	2120	2130	2140	
Broad and narrow fabrics	(16)	2210	2220	2230	2240	2261
Ysrn, thread, finishing	(16)	2269	2280			
Floor coverings	(17)	2270				
Misc textiles	(18)	2290				
Knitting	(19)	2250				
Apparel	(20)	2310	2320	2330	2340	2350
		2380	3992			
Household textiles	(21)	2390				
Logging camps	(22)	2410				
Ssw snd planing mills	(22)	2420				
Veneer and plywood	(23)	2432				
Millwork and wood products	(23)	2431	2433	2490		
Wooden containers	(24)	2440				
Household furniture	(25)	2510				
Other furniture	(25)	2520	2530	2540	2590	
Pulp mills	(25)	2610				
Paper and paperboard mills	(27)	2620	2630			
Psper products, NEC	(27)	2641	2642	2643	2645	2646
Wall and building paper	(27)	2644	2660			
Paperboard containers	(28)	2650				
Newspapers	(29)	2710				
Periodicals	(30)	2720				
Books	(30)	2730				
Business forms, blank books	(30)	2760	2782			
Commercial printing	(30)	2751	2752			
Other printing, publishing	(30)	2740	2753	2770	2789	2790
Empty						
Empty						
Empty						
Industrial chemicals	(31)	2810				
Fertilizers	(32)	2871	2872			
Pesticides & agric. chem.	(32)	2879				
Misc chemical products	(33)	2860	2890			
Plastic mat'ls. & resins	(34)	2821				
Synthetic rubber	(34)	2822				
Cellulosic fibers	(34)	2823				
Non-cellulosic fibers	(34)	2824				
Drugs	(35)	2830				
Cleaning & toilet products	(36)	2840				
Paints	(37)	2850				

5	Empty						
6	Petroleum refining[1]	(38)	2911	2990			
7	Fuel oil [1]	(38)	2911				
8	Paving and asphalt	(38)	2950				
9	Empty						
0	Tires and inner tubes	(39)	3010				
1	Rubber products	(40)	3020	3030	3060		
2	Misc plastic products	(41)	3070				
3	Leather & ind lthr products	(42)	3110	3120			
4	Footwear (fxc. rubber)	(43)	3130	3140			
5	Other leather products	(43)	3150	3160	3170	3190	
6	Glass	(44)	3210	3220	3230		
7	Structural clay products	(45)	3250				
8	Pottery	(45)	3260				
9	Cement, concrete, gypsum	(45)	3240	3270			
0	Other stone & clay products	(45)	3280	3290			
1	Steel	(46)	3310	3320	3391	3399	
2	Copper	(47)	3331	3340	3351	3362	
3	Lead	(47)	3332				
4	Zinc	(47)	3333				
5	Aluminum	(47)	3334	3352	3361		
6	Oth prim non-fer metals	(47)	3339				
7	Oth non-fer roll & draw	(47)	3356				
8	Non-ferrous wire drawing	(47)	3357				
9	Non-fer casting & forging	(47)	3369	3392			
0	Metal cans	(48)	3410				
1	Metal barrels and drums	(48)	3491				
2	Plumbing & heating equip.	(49)	3430				
3	Boiler shops	(50)	3443				
4	Oth structural metal prod.	(50)	3441	3442	3444	3446	3449
5	Screw machine products	(51)	3450				
6	Metal stampings	(51)	3460				
7	Cutlery, hand tools, hardwr	(52)	3420				
8	Misc fabricated wire prod.	(52)	3480				
9	Pipes, valves, fittings	(52)	3494	3498			

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ector 76 shows shipments of all petroleum refining. However, all fuel
l is sold to sector 77; therefore, the sales to other sectors show
rchases of gasoline, aviation fuel, and petrochemical feedstocks. The
stribution of sales for sector 77 shows purchases of residual and
stillate fuel oil, diesel fuel, and kerosene.

111	Engines and turbines	(53)	3510			
112	Farm machinery	(54)	3520			
113	Constr, mine, oilfield mach	(55)	3531	3532	3533	
114	Materials handling mach.	(55)	3534	3535	3536	3537
115	Mach. tools, metal cutting	(56)	3541			
116	Mach. tools, metal forming	(56)	3542			
117	Other metal working mach.	(56)	3544	3545	3548	
118	Special industrial mach.	(57)	3550			
119	Pumps, compressors, blowers	(58)	3561	3564		
120	Ball and roller bearings	(58)	3562			
121	Power transmission equip.	(58)	3566			
122	Industrial patterns	(58)	3565	3567	3569	
123	Computers & related mach.	(60)	3571	3573	3574	
124	Other office machinery	(60)	3572	3576	3579	
125	Service industry machinery	(61)	3580			
126	Machine shop products	(59)	3590			
127	Empty					
128	Empty					
129	Elec. measuring instrument	(62)	3611			
130	Transformers & switchgear	(62)	3612	3613		
131	Motors and generators	(63)	3621			
132	Industrial controls	(63)	3622			
133	Welding app. graphite prod.	(63)	3623	3624	3629	
134	Household appliances	(64)	3630			
135	Elec. lighting & wiring eq.	(65)	3640			
136	Radio and TV receiving	(66)	3651			
137	Phonograph records	(66)	3652			
138	Communication equipment	(67)	3660			
139	Electronic components	(68)	3670			
140	Batteries	(69)	3691	3692		
141	Engine electrical equipment	(69)	3694			
142	X-ray, elec. equip, NEC	(69)	3693	3699		
143	Empty					
144	Truck, bus, trailer bodies	(70)	3713	3715		
145	Motor vehicles	(70)	3711	3714	3717	
146	Empty					
147	Aircraft	(71)	3721			
148	Aircraft engines	(71)	3722			
149	Aircraft equipment, NEC	(71)	3723	3729		
150	Ship and boat building	(72)	3730			
151	Railroad equipment	(73)	3740			

153	Trailer coaches	(74)	3791			
154	Empty					
155	Empty					
156	Engr. & scientific instr.	(75)	3810			
157	Mech. measuring devices	(76)	3820			
158	Optical & ophthalmic goods	(78)	3830	3850		
159	Medical & surgical instr.	(77)	3840			
160	Photographic equipment	(78)	3860			
161	Empty					
162	Watches and clocks	(78)	3870			
163	Jewelry and silverware	(79)	3910	3961		
164	Toys, sport, musical instr.	(79)	3930	3940		
165	Office supplies	(79)	3950			
166	Misc manufacturing, NEC	(79)	3962	3963	3964	3980
			3994	3995	3996	3999
167	Railroads	(80)	4000	4740		
168	Buses and local transit	(82)	4100			
169	Trucking	(81)	4200	4730		
170	Water transportation	(82)	4400			
171	Airlines	(83)	4500			
172	Pipelines	(82)	4600			
173	Freight forwarding	(82)	4700	-4730	-4740	
174	Telephone and telegraph	(85)	4800	-4830		
175	Radio and TV broadcasting	(85)	4830			
176	Electric utilities	(87)	4910	4930		
177	Empty					
178	Natural gas	(88)	4920	4930		
179	Water and sewer services	(88)	4930	4940	4950	4960
180	Wholesale trade	(84)	5000			
181	Retail trade	(84)	5200	5300	5400	5500
			5800	5960	7390	
182	Banks, credit agen., brokers	(86)	6000	6100	6200	6700
183	Insurance	(86)	6300			
184	Owner-occupied dwellings	(0)	6400			
185	Real estate	(86)	6500	6600	-6561	
186	Hotel and lodging places	(86)	7000			
187	Personal & repair services	(86)	7200	7600	-7692	-7694
188	Business services	(86)	7300	7692	8100	8900
			-8921			
189	Advertising	(86)	7310			

191	Movies & amusements	(86)	7800	7900		
192	Medical services	(86)	0722	8010	8020	8030
			8070	8090		
193	Private schools & NPO	(86)	8200	8400	8600	8921
194	Post office					
195	Fed and S&L Gov. enterprises					
196	Non-competitive imports					
197	Business travel (dummy)					
198	Office supplies (dummy)					
199	Unimportant ind. (dummy)					
200	Computer rental (dummy)					

INPUT-OUTPUT ECONOMICS.

Theory and Development.

, Clopper, et al. 1985: Interindustry Forecasts of the American Eco
Lexington, Massachusetts: Lexington Books, Inc., 1974.
P. 250.

The authors describe the theoretical and practical aspects of input-ou
as applied in the University of Maryland Forecasting project (INFORUM)

on, Burgess, "The Construction of the Leontief System," The Review of
Economic Studies, 29 (1950-51) 48, pp. 19-27.

The author sets the input-output framework within the larger scope of
general equilibrium systems, and challenges the validity of Leontief's
fixed technical coefficients.

r, Anne P. and Brody, A. (eds.). Input-output Techniques. (Proceedi
of the Fifth International Conferenee on Input-output Techniques,
January 1971.) New York: American Elsevier, 1972. P. 600.

A collection of 32 papers covering such topics as structural change,
interregional trade models, and technological change forecasting.

r, Anne P. and Brody, A. Input-output Techniques. Volume 1:
Contributions to Input-output Analysis. (Volume 2: Applications of
Input-output Analysis.) Amsterdam and London: North-Holland Publish
Company, 1970.

Thirty-four papers, presented at the Fourth International Conference
on Input-output Techniques (Geneva, 1968), are included. Volume 1 st
methodological improvements in such areas as dynamic analysis and pri
analysis. Volume 2 stresses empirical and policy aspects, and includ
national and regional applications.

ry, Hollis B. and Clark, Paul G. Interindustry Economics. New York:
Wiley, 1959.

Hungarian Academy of Sciences, 1970. P. 400.

Thirty-six papers presented by Hungarian experts on the sta
problems of constructing input-output tables; regional appl
included.

Dorfman, Robert, "The Nature and Significance of Input-output,"
of Economics and Statistics, 36 (May 1954) 2, pp. 121-133.

A review of the early history of input-output economics, ar
evaluation of its limitations.

Dorfman, Robert, "Wassily Leontief's Contribution to Economics,"
Journal of Economics, 75 (December 1973) 4, pp. 430-449.

A history of the discovery and development of input-output.

Evans, W. Duane and Hoffenberg, Eric, "The Interindustry Relatio
1947," The Review of Economics and Statistics, 34 (May 1952
pp. 97-142.

A report of the first input-output table compiled by resear
Bureau of Labor Statistics and Harvard University.

Gossling, W. F. (ed.). Capital Coefficients and Dynamic Input-o
London: Input-output Publishing Co., 1975. P. 157.

Six articles concerned with technological growth and capita
the context of dynamic input-output systems.

Leontief, Wassily W. The Structure of the American Economy, 191
New York: Oxford University Press, 1951.

The original treatise on the theory and practice of interin
economics, and a description of the author's work on the fi
output table.

__________________. Input-output Economics. New York:
Oxford University Press, 1966. P. 257.

A collection of essays based upon the author's work in stat
dynamic, and applied input-output studies.

Princeton University Press, 1955. P. 371.

An early collection of articles which sought to evaluate basic research in input-output, and assess its prospects.

tone, Richard. Input-output and National Accounts. Paris: OECD, 196

tone, Richard. Mathematical Models of the Economy and other Essays. New York: Barnes & Noble, 1970. P. 335.

A collection of 19 essays reflecting the author's experience with the Cambridge Economic Growth Model, balance of payments problems, econometrics, and consumer behavior.

an, Chiou-shuang. Introduction to Input-output Economics. New York: Holt, Rinehart, and Winston, 1969. P. 134.

. Input-Output Tables: Construction and Maintenance.

llen, R. I. G. and Gossling, W. F. (eds.), Estimating and Projecting Input-output Coefficients. London: Input-output Publishing Co., 1975. P. 104.

Evaluation of "RAS" in projecting coefficients, and a discussion o ex ante projecting methods.

acharach, Michael. Biproportional Matrices and Input-output Change. Cambridge: Cambridge University Press, 1970. P. 1970.

The original explanation of estimating matrices from data on row a column sums, popularly known as the "RAS" technique.

artin, B. R., "Updating Input-output Table Coefficients," Australian Economic Papers, 11 (December 1972) 19, pp. 180-186.

Discusses the causes of coefficient change and a procedure for iteratively updating them, given forecasts of industry outputs.

. Applicability of Input-Output Economics.

International Labour Review, 65 (May 1952) 5, pp. 600-62

A look at input-output as a method of accounting and pla
the direct and indirect impacts of manpower policies. T
and mathematics of input-output are presented.

Cameron, Burgess. _Input-output Analysis and Resource Allocat_
Cambridge: Cambridge University Press, 1968. P. 109.

Considers input-output as a tool for maximizing the allo
productive resources, with emphasis on employment. Cont
on matrix operations.

b. _Regional Input-Output Economics_.

Goode, F. M., Tolley, G. C., "The Input-output Model as a Too
Analysis," in Gibson, W. L., et al. (eds.), _Methods for_
Research, Lincoln, Nebraska: University of Nebraska Pre

Hewings, G. J. D., "Regional Planning: Problems in the Appli
of Interregional Input-output analysis to State Planning
Activities," _Annals of Regional Science_, 4 (1970), pp. 1

Hirsch, Werner Z., "Input-output Techniques for Urban Governm
American Economic Review Papers and Proceedings, 58 (196

The author presents applications of input-output models
Government expenditure projections and regional planning

Isard, Walter and Langford, T. W. _Regional Input-output Stud_
Recollections, Reflections, and Diverse Notes on the Phi
Study. Cambridge, Massachusetts: The MIT Press, 1971.

Detailed explanation of the methodology involved in cons
operating a regional input-output system. The authors d
application of the completed model to defense expenditur
environmental quality analysis.

Polenske, Karen R. _A Multiregional Input-output Model for th_
United States. U.S. Department of Commerce, Economic De
Administration, 1970. Paper No. 21.

ebout, Charles M., "Regional and Interregional Input-output Models: Appraisal," Southern Economic Journal, 24 (October 1957), pp. 140-

A review and critique of the premises of regional input-output, including the problems of production functions and sector agglomer

lliamson, R. B., "Simple Input-output Models for Area Economic Analys Land Economics, 46 (1970) 3, pp. 333-338.

An illustration of the use of a small input-output model in region analysis, as a substitute (and an extension) of economic base theo

Input-Output and Economic Projections.

ezdek, R. H. and Wendling, R. M., "Current and Constant Dollar Input-O Forecasts of the U.S. Economy," Journal of the American Statistica Association, 71 (September 1976) 355, pp. 543-559.

The authors empirically test the accuracy of input-output forecast using BEA tables in current and constant dollars, and discuss projection improvements in light of their results.

hapiro, Arlene K. Input-output Analysis as a Predictive Tool. U.S. Department of Commerce, Bureau of Economic Analysis. (Washington, D.C.: 1972.) P. 78.

This study compares projections obtained through input-output anal those of two regression models, and GNP and final demand "blowup" Input-output is found to produce better results than other methods percentage-error of projected outputs is low; methods are otherwis

accara, Beatrice N. "Macroeconomic Projections Useful in Long-range I output Analysis." (Talk before a symposium on Practical uses of I output Tables, New York, January 28, 1970.) P. 14.

accara, Beatrice N., "An Input-output Method for Long-range Economic Projections," Survey of Current Business, 51 (July 1971), pp. 47-56.

General Topics.

erman, Jack, "Interindustry Employment Requirements," Monthly Labor Review, 88 (July 1965) 7, pp. 841-850.

________________, "Studies of Long Term Economic Growth," Monthly Labor Review, 88 (August 1965) 8, pp. 983-987.

cobs, Eva E. and Kutscher, Ronald E., "Factors Affecting Changes in Industry Employment," Monthly Labor Review, 90 (April 1967) 4, pp.

irow, Lester, "A Fiscal Policy Model of the United States," Survey of Current Business, 49 (June 1969) 6, pp. 45-64.

Projections.

wman, Charles T., and Morlan, Terry H., "Revised Projections of the U Economy to 1980 and 1985," Monthly Labor Review, 99 (March 1976) 3 pp. 9-2.

tscher, Ronald D. "Revised BLS Projections to 1980 and 1985: An Overview," Monthly Labor Review, 99 (March 1976) 3, pp. 3-8.

oney, Thomas J. and Tschetter, John H., "Revised Industry Projections to 1985," Monthly Labor Review, 99 (November 1976) 11, pp. 3-9.

rsonick, Valerie A. and Sylvester, Robert A., "Evaluation of BLS 1970 Economic and Employment Projections," Monthly Labor Review, 99 (August 1976) 8, pp. 13-26.

Input-Output Coefficients Studies.

ck Faucett Associates, Inc. Projections to 1970 of Input Coefficient for Selected Construction Activities. Silver Spring, Maryland, 1974. Unpublished.

____________________________. Trends in Energy Consumption 1948-1971. Unpublished, 1974.

unpublished.

________________________________. Projections of 1958 Input-output Coefficients to 1970. Cambridge, Massachusetts: Harvard Universi unpublished.

stvan, Rudyard. 1980 Inputs for Private Electric Utilities. Harvard Economic Research Project, August 1972.

.S. Department of Agriculture, Economic Research Service. Agriculture 1970: Its Markets and Selected Characteristica of Ita Structure. June 1963. Unpublished.

.S. Department of Labor, Bureau of Labor Statistics. 1970 Inut-output Coefficients. Report 326, 1967.

Final Demand Studies.

Government.

eming, Thomas F., Jr., "State and Local Government Spending in 1975," Monthly Labor Review, 94 (August 1971) 8, pp. 19-28.

.iver, Richard P., "The Employment Effects of Defense Expenditures," Monthly Labor Review, 90 (September 1967) 9, pp. 9-15.

______________________, "Increases in Defense-Related Employment During the Vietnam Buildup," Monthly Labor Review, 93 (February 1970) 2, pp. 3-10.

______________________, "Employment Effects of Reduced Defense Spending Monthly Labor Review, 94 (December 1971) 12, pp. 3-11.

ilsh, James I., "Federal Highway Programs and Employment," Monthly La Review, 91 (August 1968) 8, pp. 37-39.

Personal Consumption Expenditures.

outhakker, Hendrick and Taylor, Lester D. Consumer Demand in the Unit States, 1929-1970. Cambridge, Massachusetts: Harvard University Press, 1966. Volume 126.

Taylor, Lester D. Combining Time Series and Cross Sectional Data. Cambridge, Massachusetts: Harvard University, 1967. Unpublishe

__________. Projecting Consumer Expenditures in 1970: A Final Cambridge, Massachusetts: Harvard University, 1967. Unpublishe

c. Investment.

Grose, Lawrence, et al., "New Estimates of Fixed Business Capital in United States," Survey of Current Business, 46 (December 1966) 1 pp. 34-40.

Jack Faucett Associates, Inc. Development of a Matix of Interindustr Transactions in Capital Goods, 1963. Silver Spring, Maryland, 1 Unpublished.

__________. Methodology for Constructing Gross and Capital Stock Series for Input-output Sectors. 1967, unpublishe

__________. Projections of Business Investment Lev to 1970. Silver Spring, Maryland, 1965. Unpublished.

__________. Fixed Capital Stocks by Industry Secto 1947-70. Silver Spring, 1971. Unpublished.

__________. Employment and Output Estimates for Non-manufacturing I-O Sectors, 1947-72. Silver Spring, Maryland unpublished.

Jaszi, George, et al., "Expansion of Fixed Business Capital in the Un States," Survey of Current Business, 42 (November 1962) 11, pp.9

Kutscher, Ronald D. and Walsh, James I., "How Business Investment Aff Employment," Monthly Labor Review 91 (November 1968) 11, pp. 35-

U.S. Department of Labor, Bureau of Labor Statistics. Capital Flows, 1958. Bulletin 1601, 1968.

__________. Capital Stocks Production Functions, and Investment Functions For Selected Inpu output Sectors. (Jack Faucett Associates, Inc., Report No. 355, February 1970.)

___, "Report on Employment Related to Exports," Monthly Labor Review, (June 1969) 6, pp. 16-20.

idge, Donald P. and Saunders, Norman C., "Employment and Exports, 1968-1973," Monthly Labor Review, 96 (August 1973) 8, pp. 16-36.

ish, Evelyn M. A Pattern of Balances of Payment Between World region in 1970. Staff Working Paper in Economics and Statistics, No. 9. U.S. Department of Commerce, Office of Business Economics, 1964.

n, Daniel, "Domestic Jobs Attributable to U.S. Exports," Monthly Labo Review, 91 (December 1968) 12, pp. 12-20.

planning issues.

There are three principal components to the methodology: generic economies, defining representative technologies, and ca component proportions. Background for each of these topics, as appropriate methodology is presented below:

1.0 Delineation of Generic Economies

1.1 Background

A final demand change in a local economy will produce effect, the level of which will vary with the industrial struct economy. Multiplier estimation, then, must be undertaken withi of a given industrial structure. Since this paper is taking a tive, the task becomes one of aggregating local area informatio level. The aggregation, however, must be achieved in a manner regional industrial structure that reasonably depicts the quali economies being aggregated. On this basis generic regional eco formed as outlined below.

1.2 Methodology

- Divide the national economy into two categories: Sta Metropolitan Statistical Areas (SMSA's) and non-SMSA BEA economic areas (see figure 3 in section I of the map of BEA economic areas);

- Subdivide the above two categories into large and sma on employment levels; and

- Subdivide the above four areas according to geographi and rates of employment growth over the period 1971-1

The size of a multiplier impact in a local economy is de
only by the local industrial structure but also by the i
menta of the activity initiating the local economic pert
Varying input requirements will engender varying impacts
equal economies. In order to allow for this aspect of m
estimation, input requirements for conventional and sola
were assembled. Three technologies from this set were c
represent a range of possible energy technology alternat
selected technologies are representative of the input re
three general types of energy technology alternatives:
conventional electric generation facilities; centralized
generation facilities;** solar collector facilities. Th
type of facilities not represented in this scheme are bi
ties. The input requirements for these facilities were
that no one technology represented them well. Research
plier impact associated with biomass technologies should
on a case by case basis as generalizations from a single
be misleading. Inputs for centralized wood-fired steam
however, to be similar to those for the technologies und
ized conventional electric generation facilities." Simi
are applicable to passive solar technologies. An approp
in the case of passive might be to examine input require
residential or commercial building construction. The me
choosing the three representative technologies is outli
This methodology also yields the direct component of the
multiplier.

---

*See exhibit E-1 for a more detailed listing of the representativ

**It should be noted, however, that solar thermal electric plants
similar in input requirements to the centralized conventional ele
than to wind energy conversion systems (WECS).

o Group technologies qualitatively (i.e., centralized c centralized solar, decentralized solar);

o Regress the input requirements of each technology in the input requirements of the other technologies in t

o Use the values of the coefficients of determination d the regressions to decide which technology in each gr representative of all technologies in the group; and

o Screen the technologies chosen on the basis of the re analysis to ensure wide geographic applicability and implementation probability.

0 Calculation of the Indirect Component of Regional Multipliers

3.1 Background

The indirect component of the multiplier is estimated on of research conducted by the BEA/RIMS staff. This resea an equation which estimates the indirect component as a the direct component and several variables describing th structure of the impact region. The methodology for thi is outlined below.

3.2 Methodology

o Assemble the data needed to estimate the indirect com regional multipliers via the BEA/RIMS methodology;*

$$I_j = e^{B_i}(D_j^t)^{1.103}$$

ere

I_j^t = indirect input of the multiplier associated with the t^{th} te

B_i = a combination of the several variables describing the struc i^{th} region

D_j^t = the j^{th} direct input of the multiplier associated with the

S_2^r = the regional total non-government earnings pr
of U.S. total non-government earnings in the

D_j^t = the j^{th} input requirement of the t^{th} technolo

k = the parameter aasociated with the K^{th} variabl
RIMS multiplier estimation equation

- Combine the region and technology specific data with t parameters in the manner indicated by the RIMS apecifi derive estimates of the indirect component of regional associated with a given technology; and

- Use D_j^t and I_j^t to derive the direct component proportio impact technology for the regiona delineated in (1) ab

TECHNOLOGIES	COST CALCULATION I
1. Centralized Conventional Energy Technologies	
Coal-fired Steam Electric	Strategic Environmenta
Oil-fired Steam Electric*	System, Working Paper
Gas-fired Steam Electric	for the Energy Investm
Nuclear Reactor	Module
2. Solar Collector Technologies	
SHACOB Active System	MITRE Corporation, Sys and Engineering Cost I Technologies, Vol. II.
AIPH Flat Plate Hot Water System	Ibid., Vol. III, pp. 4
AIPH Parabolic Trough Steam System*	Ibid., Vol. III, pp. 5
AIPH Parabolic Dish Total Energy System	Ibid., Vol. III, p. 64
Residential Photovoltaics	Ibid., Vol. VIII, pp.
Centralized Photovoltaics	Ibid., Vol. VIII, pp.
. Centralized Wind Energy Conversion System*	Ibid., Vol. VI, p. 8

S_2^r = the regional total non-government earnings pro
of U.S. total non-government earnings in the r

D_j^t = the j^{th} input requirement of the t^{th} technolog

k = the parameter associated with the K^{th} variable
RIMS multiplier estimation equation

o Combine the region and technology specific data with th
parameters in the manner indicated by the RIMS specific
derive estimates of the indirect component of regional
associated with a given technology; and

o Use D_j^t and I_j^t to derive the direct component proportion
impact technology for the regiona delineated in (1) abo

Technologies	
Coal-fired Steam Electric	Strategic Environme
Oil-fired Steam Electric*	System, Working Pap
Gas-fired Steam Electric	for the Energy Inve
Nuclear Reactor	Module
2. Solar Collector Technologies	
SHACOB Active System	MITRE Corporation,
	and Engineering Cos
	Technologies, Vol.
AIPH Flat Plate Hot Water System	Ibid., Vol. III, pp
AIPH Parabolic Trough Steam System*	Ibid., Vol. III, pp
AIPH Parabolic Dish Total Energy System	Ibid., Vol. III, p.
Residential Photovoltaics	Ibid., Vol. VIII, p
Centralized Photovoltaics	Ibid., Vol. VIII, p
3. Centralized Wind Energy Conversion System*	Ibid., Vol. VI, p.

*Indicates a representative technology.

065	Akron, OH	S	ENC	266,564
040	Albany, GA	S	SE	45,952
007	Albany-Schenectady-Troy, NY	L	NE	339,491
160	Albuquerque, NM	S	Mtn	174,123
117	Alexander, LA	S	WSC	55,517
018	Allentown-Bethlehem-Easton, PA-NJ	S	NE	274,344
016	Altoona, PA	S	NE	55,569
135	Amarillo, TX	S	WSC	77,108
180	Anaheim-Santa Ana-Garden Grove, CA@	L	Pac.	688,317
182	Anchorage, AK@	S	Pac.	94,480
078	Anderson, IN@	S	WSC	58,275
071	Ann Arbor, MI	S	WNC	131,283
049	Anniston, AL	S	SE	51,584
094	Appleton-Oahkosh, WI	S	ENC	131,400
030	Asheville, NC	S	SE	77,427
036	Atlanta, GA	L	SE	896,499
018	Atlantic City, NJ	S	NE	79,538
035	Augusta, GA-SC	S	SE	137,900

179	Bakersfield, CA	S	Pac	164,179
019	Baltimore, MD	L	SE	968,090
114	Baton Rouge, LA@	S	WSC	183,876
074	Battle Creek, MI	S	WNC	75,752
072	Bay City, MI@	S	WNC	39,294
121	Beaumont-Port Arthur-Orange, TX	S	WSC	152,433
155	Billinga, MT	S	Mtn	48,970
113	Biloxi-Gulfport, MS	S	SE	76,227
011	Binghamton, NY-PA	S	NE	122,983
049	Birmingham, AL	L	SE	364,203
079	Bloomington, IN	S	ENC	40,856
087	Bloomington-Normal, IL	S	ENC	53,180
167	Boise City, ID	S	Mtn	75,419
004	Boaton-Lowell-Brockton-Lawrence-Haverhill, MA-NH	L	N.Eng.	1,781,045
044	Bradenton, FL@	S	SE	40,609
012	Bridgeport-Stamford-Norwalk-Danbury, CT	L	NE	345,532

131	Brownsville-Harlingen-San Benito, TX	S	WSC	61,903
122	Bryan-College Station, TX	S	WSC	32,236
010	Buffalo, NY@	L	NE	532,816
003	Burlington, VT	S	NE	51,522
028	Burlington, NC@	S	SE	46,993
065	Canton, OH	S	ENC	162,717
100	Cedar Rapids, IA	S	WNC	82,088
084	Champaign-Urbana-Rantoul, IL	S	ENC	81,050
034	Charleston-North Charleston, SC	S	SE	169,249
060	Charleston, WV	S	SE	118,414
029	Charlotte-Gastonia, NC	L	SE	322,886
051	Chattanooga, TN-GA	S	SE	184,493
156	Cheyenne, WY	S	Mtn	33,442
083	Chicago, IL	L	ENC	3,294,038
067	Cincinnati, OH-KY-IN	L	ENC	602,393
054	Clarksville-Hopkinsville, TN-KY@	S	SE	74,496
065	Cleveland, OH	L	ENC	932,681

158	Colorado Springs, CO	S	Mtn	150
106	Columbia, MO	S	WNC	47
032	Columbia, SC	S	SE	187
037	Columbus, GA-AL@	S	SE	108
066	Columbus, OH	L	ENC	489
130	Corpus Christi, TX	S	WSC	124
125	Dallas-Fort Worth, TX	L	WSC	1,288
099	Davenport-Rock Island-Moline, IA-IL	S	ENC/WNC	180
068	Dayton, OH	L	ENC	380
042	Daytona Beach, FL	S	SE	74
085	Decatur, IL	S	ENC	61
157	Denver-Boulder, CO	L	Mtn	717
104	Des Moines, IA	S	WNC	187
071	Detroit, MI	L	ENC	1,788
098	Dubuque, IA	S	WNC	47
095	Duluth-Superior, MN-WI	S	ENC/WNC	115
092	Eau Claire, WI	S	ENC	51
133	El Paso, TX	S	WSC	173
011	Elmira, NY@	S	NE	40

Economic Area Number	Region	Size*	Location**	1970 Employment
015	Erie, PA	S	NE	120,523
173	Eugene-Springfield, OR	S	Pac	100,104
080	Evansville, IN-KY	S	ENC/SE	135,973
149	Fargo-Moorhead, ND-MN	S	WNC	68,508
026	Fayetteville, NC	S	SE	112,809
109	Fayetteville-Springdale, AR	S	WSC	69,671
071	Flint, MI	S	ENC	196,955
050	Florence, AL	S	SE	51,048
157	Fort Collins, CO	S	Mtn	49,239
043	Fort Lauderdale-Hollywood, FL	S	SE	288,478
044	Fort Myers, FL@	S	SE	52,662
110	Fort Smith, AR-OK	S	WSC	77,263
076	Fort Wayne, IN	S	ENC	185,324
179	Fresno, CA	S	Pac	220,822
049	Cadsden, AL@	S	SE	35,043
041	Cainesville, FL	S	SE	61,941
122	Galveston-Texas City, TX	S	WSC	75,623
083	Cary-Hammond-East Chicago, IN	S	ENC	261,260

Grand Rapids, MI	S	ENC	260,052	2.437
Great Falls, MI	S	Mtn	38,930	1.807
Greeley, CO	S	Mtn	45,250	5.904
Green Bay, WI	S	ENC	76,316	3.216
Greensboro-Winston Salem-High Point, NC	L	SE	406,426	1.634
Greenville-Spartanburg, SC	S	SE	258,073	2.638
Hamilton-Middleton, OH	S	ENC	86,517	1.071
Harrisburg, PA	S	NE	225,613	1.796
Hartford-New Britain-Bristol, CT	L	NE	511,088	1.273
Honolulu, HI	L	Pac	373,277	2.219
Houston, TX[@]	L	WSC	1,217,678	5.656
Huntington-Ashland, WV-KY-OH	S	ENC	113,079	1.018
Huntsville, AL	S	SE	126,770	1.406
Indianapolis, IN	L	ENC	545,634	1.501
Jackson, MI	S	ENC	58,105	0.854
Jackson, MS	S	ESC	149,841	2.980
Jacksonville, FL	L	SE	315,057	2.408

052	Johnson City-Kingsport-Bristol, TN-VA	S	SE	167,
016	Johnatown, PA	S	NE	99,
074	Kalamazoo-Portage, MI	S	ENC	117,
083	Kankakee, IL	S	ENC	43,
105	Kansas City, MO-KS	L	WNC	642,
083	Kenosha, WI	S	ENC	46,
124	Killeen-Temple, TX[@]	S	WSC	108,
053	Knoxville, IN	S	SE	200,
077	Kokomo, IN	S	ENC	51,
091	LaCrosse, WI	S	WSC	43,
115	Lafayette, LA	S	WSC	65,
082	Lafayette-Weat Lafayette, IN	S	ENC	55,
116	Lake Charles, LA	S	WSC	61,
044	Lakeland-Winter Haven, FL	S	SE	115,
017	Lancaater, PA	S	NE	159,
074	Lansing, East Lansing, MI	S	ENC	196,
129	Laredo, TX	S	WSC	27,

Lawrence, KS	S	WNC	26,905	3.0930
Lawton, OK	S	WSC	52,292	1.2957
Lewiston-Auburn, ME	S	NE	41,313	1.6406
Lexington-Fayette, KY	S	SE	156,919	3.3285
Lima, OH	S	ENC	94,747	0.8655
Lincoln, NE	S	WNC	101,320	2.8453
Little Rock-North Little Rock, AR	S	WSC	187,959	2.9930
Long Branch-Asbury Park, NJ	S	NE	162,696	0.9683
Longview, TX	S	WSC	62,588	3.3084
Lorain-Elyria, OH	S	ENC	97,145	0.9542
Los Angeles-Long Besch, CA	L	PAC	3,423,270	1.6727
Louisville, KY-IN	L	ENG	406,641	0.7181
Lubbock, TX	S	WSC	92,404	4.1464
Lynchburg, VA	S	SE	72,755	1.8065
Macon, GA	S	SE	113,369	1.2872
Madison, WI	S	ENC	168,011	2.6990
Manchester-Nashua, NH	S	NE	120,509	1.9335

Area Number	Region	Size*	Location	Employment
065	Mansfield, OH@	S	ENC	58,673
131	McAllen-Pharr-Edinburg, TX@	S	WSC	73,281
042	Melbourne-Titusville-Cocoa, FL	S	SE	90,515
055	Memphis-TN-AR-MS	L	ESC/WSC	400,661
043	Miami, FL	L	SE	682,665
132	Midland, TX	S	WSC	36,060
089	Milwaukee, WI	L	ENC	671,969
096	Minneapolis-St Paul, MN-WI	L	WNC/ENC	1,019,790
047	Mobile, AL	S	SE	159,465
178	Modesto, CA	S	Pac	99,231
118	Monroe, LA	S	WSC	52,520
048	Montogomery, AL	S	SE	117,619
078	Muncie, IN@	S	ENC	50,342
073	Muskegon-Norton Shores-Muskegon Heights, MI	S	ENC	66,401
054	Nashville-Davidson, IN	L	SE	380,581
012	Nassau-Suffolk, NY	L	NE	903,939
004	New Bedford-Fall River, MA	S	NE	187,235

Region	Size	Location	Employment	Growth Rate
New Brunswick-Perth Amboy-Sayreville, NJ	S	NE	258,164	2.1927
New Haven-Waterbury-Meriden, CT	L	NE	323,098	0.3366
New London-Norwich, CT	S	NE	111,272	2.2807
New Orleana, LA	L	WSC	513,662	2.6275
New York, NY-NJ@	L	NE	4,369,171	-1.6770
Newark, NJ@	L	NE	930,498	-0.1271
Newport Newa-Hampton, VA	S	SE	165,285	1.7246
Norfolk-Virginia Beach-Portsmouth, VA-NC	L	SE	355,964	1.5633
Northeast Pennaylvania, PA	S	NE	254,463	0.0559
Odesaa, TX	S	WSC	47,455	5.0216
Oklahoma City, OK	L	WSC	361,199	1.9334
Omaha, NE-IA	S	WNC	278,763	1.5167
Orlando, FL@	S	SE	262,744	5.1940
Owenaboro, KY@	S	SE	34,813	0.4430
Oxnard-Simi Valley-Ventura, CA	S	Pac	152,582	3.9871
Panama City, FL	S	SE	36,837	3.8178

047	Pascagoula-Mosa Point, MS@	S	SE	55,515
012	Paterson-Clifton-Passsic, NJ@	S	NE	194,983
046	Pensacola, FL	S	SE	109,189
087	Peoria, IL	S	ENC	172,503
022	Petersburg-Colonial Heights-Hopewell, VA@	S	SE	57,818
018	Philadelphia, PA-NJ@	L	NE	2,026,371
162	Phoenix, AZ	L	Mtn	518,770
111	Pine Bluff, AR	S	Mtn	33,909
016	Pittsburgh, PA	L	NE	976,223
006	Pittsfield, MA	S	NE	65,454
002	Portland, ME	S	NE	115,393
172	Portland, OR-WA	L	Pac	525,289
012	Poughkeepsie, NY	S	NE	96,789
005	Providence-Warwick-Pawtucket, RI	L	NE	384,293
165	Provo-Orem, UT	S	Mtn	55,500
158	Pueblo, CO	S	Mtn	52,172

027	Raleigh-Durham, NC	S	SE	255,686
018	Reading, PA	S	NE	142,578
164	Reno, NV	S	Mtn	86,926
169	Richland-Kennewick, WA@	S	WNC	53,918
022	Richmond, VA	L	SE	325,001
180	Riverside-San Bernardino-Ontario, CA	L	Pac	443,151
021	Roanoke, VA	S	SE	109,315
097	Rochester, MN	S	WNC	50,410
009	Rocheater, NY	L	NE	435,305
088	Rockford, IL	S	ENC	126,026
177	Sacramento, CA	L	Pac	383,377
072	Saginaw, MI	S	ENC	93,057
096	St Cloud, MN	S	WNC	60,551
105	St. Joaeph, MO@	S	WNC	43,793
107	St. Louia, MO-IL	L	WNC/ENC	1,064,540
172	Salem, OR	S	Pac	91,760
176	Salinaa-Seaaide-Monterey, CA@	S	Pac	133,731

128	San Angelo, TX	S	WSC	35,752
129	San Antonio, TX	L	WSC	422,618
181	San Diego, CA	L	Pac	685,027
176	San Franciaco-Oakland, CA@	L	Pac	1,546,799
176	San Jose, CA	L	Pac	553,972
180	Santa Barbara-Santa Maria-Lompoc, CA	S	Pac	123,716
176	Santa Cruz, CA	S	Pac	57,739
176	Santa Roaa, CA	S	Pac	88,610
044	Sarasota, FL	S	SE	61,068
039	Savannah, GA	S	SE	97,418
171	Seattle-Everett, WA	L	Pac	657,208
125	Sherman-Denaion, TX@	S	WSC	35,208
117	Shreveport, LA	S	WSC	160,475
103	Sioux City, IA-NE	S	WNC	60,295
147	Sioux Falls, SD	S	WNC	54,839
075	South Bend, IN	S	ENC	123,012
168	Spokane, WA	S	Pac	131,293
085	Springfield, IL	S	ENC	97,944

8	Springfield, MO	S	WNC	89,815	2.
8	Springfield, OH@	S	ENC	65,843	-0.
6	Springfield-Chicopee-Holyoke, MA	S	NE	236,304	0.
3	Steubenville-Weirton, OH-WV	S	ENC/SE	69,616	0.
3	Stockton, CA	S	Pac	141,188	3.
3	Syracuae, NY	S	NE	266,057	0.
1	Tacoma, WA@	S	Pac	170,110	0.
5	Tallahassee, FL	S	SE	62,677	4.
4	Tampa-St. Petersburg, FL	L	SE	504,194	3.
[illegible]	Terre Haute, IN	S	ENC	70,564	0.
9	Texarkana, TX-Texarkana, AR@	S	WSC	50,087	1.
0	Toledo, OH-MI	L	ENC	318,179	0.
[illegible]	Topeka, KS@	S	WNC	90,710	0.
3	Trenton, NJ	S	NE	167,285	1.5
[illegible]	Tucson, AZ	S	Mtn	172,708	3.
[illegible]	Tulaa, OK	S	WSC	290,637	4.5
[illegible]	Tuacalooaa, AL	S	SE	53,600	2.
0	Tyler, TX	S	WSC	52,679	3.4

176	Vallejo-Fairfield-Napa, CA	S	Pac	115,183
018	Vineland-Millville-Bridgeton, NJ	S	NE	58,242
124	Waco, TX	S	WSC	71,325
020	Washington, DC-MD-VA	L	SE	1,590,643
101	Waterloo-Cedar Falls, IA	S	WNC	66,539
043	West Palm Beach, Boca Raton, FL	S	SE	179,249
063	Wheeling, WV-OH	S	ENC	73,868
139	Wichita, KS	S	WNC	207,349
126	Wichita Falls, TX@	S	WSC	66,416
014	Williamsport, PA	S	NE	51,566
018	Wilmington, DE-NJ-MD	S	SE	239,178
025	Wilmington, NC	S	SE	54,392
004	Worcester-Fitchburg-Leominster, MA	S	NE	272,506
170	Yakima, WA	S	Pac	73,466
017	York, PA	S	NE	156,469
064	Youngstown-Warren, OH	S	ENC	222,031

SE = Southesst

ENC = East North Central

WNC = West North Central

WSC = West South Central

Mtn = Mountain

Pac = Pacific

aress excluded on the basis of statistical consideration.

2	Portland-Lewiston, ME	S	NE	162,137
3	Burlington, VT	L	NE	186,299
4	Boston, MA@	S	NE	165,701
5	Providence-Warwick-Pawtucket, RI@	S	NE	29,360
6	Hartford-New Haven-Springfield, CT-MA	S	NE	162,155
7	Albany-Schenectady-Troy, NY	S	NE	159,447
8	Syracuse-Utica, NY	S	NE	139,027
9	Rochester, NY	S	NE	44,885
10	Buffalo, NY	S	NE	145,280
11	Binghamton-Elmira, NY	S	NE	174,019
12	New York, NY	L	NE	303,427
13	Scranton-Wilkes-Barre, PA	S	NE	46,911
14	Williamsport, PA	L	NE	198,768
15	Erie, PA	S	NE	95,050
16	Pittsburgh, PA	L	NE	218,045
17	Harrisburg-York-Lancaster, PA	S	NE	133,592

Philadelphia, PA	L	NE	358,003	0.8701
Baltimore, MD	S	SE	123,371	1.9186
Washington, DC	L	SE	263,869	1.7576
Roanoke-Lynchburg, VA	L	SE	312,266	1.4579
Richmond, VA	S	SE	172,743	1.6454
Norfolk-Virginia Beach-Newport News, VA	S	SE	69,873	1.8020
Rocky Mount-Wilaon-Greenville, NC	L	SE	334,569	2.3502
Wilmington, NC	S	SE	104,106	0.6603
Fayetteville, NC	S	SE	105,457	1.9268
Raleigh-Durham, NC	S	SE	139,524	1.6633
Creensboro-Winston-Salem-High Point, NC	S	SE	158,422	1.6130
Charlotte, NC	L	SE	424,838	1.1374
Aaheville, NC	S	SE	106,664	2.3578
Greenville-Spartanburg, SC	S	SE	171,520	1.2994
Columbia, SC	S	SE	136,958	1.8967
Florence, SC	L	SE	197,484	2.1233

	Charleston, SC	S	SE	11,456
35	Augusta, GA	S	SE	69,394
36	Atlanta, GA	L	SE	332,446
37	Columbus, GA	S	SE	97,939
38	Macon, GA@	S	SE	92,975
39	Savannah, GA	S	SE	138,923
40	Albany, GA	S	SE	158,649
41	Jacksonville, FL	S	SE	137,772
42	Orlando-Melbourne-Daytona Beach, FL	S	SE	40,615
43	Miami-Fort Lauderdale, FL	S	SE	99,582
44	Tampa-St. Petersburg, FL@	S	SE	74,645
45	Tallahassee, FL	S	SE	47,366
46	Pensacola-Panama City, FL	S	SE	59,729
47	Mobile, AL	S	SE	68,703
48	Montogomery, AL	L	SE	200,601
49	Birmingham, AL	S	SE	142,237
50	Huntsville-Florence, AL	S	SE	67,654

51	Chattanooga, TN	S	SE	163,634	3
52	Johnson City-Kingsport-Briatol, TN,VA	S	SE	151,991	2
53	Knoxville, TN	L	SE	186,650	2
54	Nashville, TN	L	SE	312,453	2
55	Memphis, TN	L	SE	679,883	1.
56	Paducah, KY	S	SE	96,726	1
57	Louiaville, KY	S	SE	148,780	0.
58	Lexington, KY	L	SE	197,546	2.
59	Huntington, WV	S	SE	108,659	3.
60	Charleston, WV	S	SE	123,805	3.
61	Morganton-Fairmont, WV	S	SE	130,504	1
62	Parkeraburg, WV@	S	SE	8,099	4.
63	Wheeling-Steubenville-Wierton, WV-OH	S	SE/ENC	24,333	1.
64	Youngatown-Warren, OH	S	ENC	122,136	0.
65	Cleveland, OH	L	ENC	234,857	1.
66	Columbua, OH	L	ENC	287,287	0.
67	Cincinnati, OH	S	ENC	103,700	1.

68	Dayton, OH	S	ENC	55,019
69	Lima, OH	S	ENC	28,164
70	Toledo, OH	S	ENC	136,479
71	Detroit, MI	S	ENC	13,507
72	Saginaw-Bay City, MI	L	ENC	185,052
73	Grand Rapida, MI	S	ENC	149,017
74	Lanaing-Kalamazoo, MI	S	ENC	30,631
75	South Bend, IN	L	ENC	228,277
76	Fort Wayne, IN	S	ENC	90,883
77	Kokomo-Marion, IN	S	ENC	88,965
79	Indianapolia, IN	S	ENC	126,365
80	Evansville, IN	S	ENC	152,542
81	Terre Haute, IN	S	ENC	21,223
82	Lafayette, IN	S	ENC	60,183
83	Chicago, IL	L	ENC	225,685
84	Champaign-Urbana, IL	S	ENC	101,880
85	Springfield-Decatur, IL	S	ENC	76,158
86	Quincy, IL	S	ENC	70,787

87	Peoria, IL	S	ENC	87,833
88	Rockford, IL	S	ENC	115,482
89	Milwaukee, WI	S	ENC	132,701
90	Madison, WI	S	ENC	77,059
91	LaCrosse, WI	S	ENC	84,276
92	EauClaire, WI	S	ENC	46,576
93	Wausau, WI	S	ENC	165,467
94	Appleton-Green Bay-Oshkosh, WI	L	ENC	258,999
95	Duluth, MN	S	WNC	62,784
96	Minneapolis-St Paul, MN	L	WNC	344,602
97	Rochester, MN	S	WNC	73,265
98	Dubuque, IA	S	WNC	83,188
99	Davenport-Rock Island-Moline, IN-IL	S	WNL/ENC	157,210
100	Cedar Rapids, IA	S	WNC	81,173
101	Waterloo, IA	S	WNC	129,572
102	Fort Dodge, IA	S	WNC	130,548
103	Sioux City, IA	S	WNC	133,113
104	Des Moines, IA	L	WNC	221,672

105	Kansas City, MO	L	WNC	201,923
106	Columbia, MO	S	WNC	151,934
107	St. Louis, MO	L	WNC	404,747
108	Springfield, MO	L	WNC	303,226
109	Fayetteville, AR@	S	WSC	47,320
110	Fort Smith, AR	S	WSC	62,287
111	Little Rock, North Little Rock, AR	L	WSC	273,340
112	Jackaon, MS	L	SE	290,753
113	New Orleans, LA	L	WSC	223,124
114	Baton Rouge, LA	S	WSC	65,948
115	Lafayette, LA	S	WSC	130,870
116	Lake Charlea, LA@	S	WSC	48,440
117	Shreveport, LA	S	WSC	54,370
118	Monroe, LA	S	WSC	78,978
119	Texarkana, TX	S	WSC	91,971
120	Tyler-Longview, TX	S	WSC	133,199
121	Beaumont-Port Arthur, TX	S	WSC	17,614
122	Houaton, TX	S	WSC	171,822
123	Auatin, TX	S	WSC	27,429

24	Waco-Killeen-Temple, TX	S	WSC	51,925	0
25	Dallas-Fort Worth, TX	S	WSC	119,864	1
26	Wichita Falls, TX	S	WSC	24,367	1
27	Abilene, TX	S	WSC	65,548	1
28	San Angelo, TX	S	WSC	27,026	1
29	San Antonio, TX	S	WSC	100,356	2
30	Corpus Christi, TX	S	WSC	50,134	0
31	Brownsville-McAllen-Harlingen, TX	S	WSC	9,686	3
32	Odessa-Midland, TX	S	WSC	48,948	1
33	El Paso, TX	S	WSC	114,735	2
34	Lubbock, TX	S	WSC	102,486	1
35	Amarillo, TX	S	WSC	134,922	2
36	Lawton, OK	S	WSC	53,273	1
37	Oklahoma City, OK	L	WSC	215,773	2
38	Tulsa, OK	S	WSC	131,265	2
39	Wichita, KS	L	WNC	218,327	2
40	Salina, KS	S	WNC	120,256	2
41	Topeka, KS	S	WNC	101,663	0

142	Lincoln, NE	S	WNC	70,100
143	Omaha, NE	S	WNC	117,348
144	Grand Island, NE	S	WNC	174,906
145	Scotts Bluff, NE	S	WNC	50,619
146	Rapid City, SD	S	WNC	108,131
147	Sioux Falls, SD	S	WNC	151,596
148	Aberdeen, SD	S	WNC	61,653
149	Fargo-Moorhead, NE-MN	S	WNC	92,707
150	Grand Folks, ND	S	WNC	86,294
151	Bismarck, ND	S	WNC	70,528
152	Minot, ND	S	WNC	87,247
153	Great Falls, MT@	S	Mtn	67,477
154	Missoula, MT	S	Mtn	101,193
155	Billings, MT	S	Mtn	88,144
156	Cheyenne-Casper, WY	S	Mtn	84,777
157	Denver, CO	S	Mtn	47,043
158	Colorado Springs-Pueblo, CO	S	Mtn	65,393
159	Grand Junction, CO@	S	Mtn	107,864
160	Albuquerque, NM	S	Mtn	136,027

r	Region	Size*	Location**	1976 Employment	1971-1976 Growth Rat
	Tucson, AZ@	S	Mtn	45,790	0.8944
	Phoenix, AZ	S	Mtn	153,481	3.3128
	Las Vegas, NV@	S	Mtn	23,871	1.4346
	Reno, NV	S	Mtn	55,037	4.0601
	Salt Lake City-Ogden, UT	S	Mtn	115,848	5.2319
	Pocatello-Idaho Falls, ID	S	Mtn	168,619	4.8206
	Boise City, ID	S	Mtn	80,958	3.6089
	Spokane, WA	S	Pac	125,894	2.8469
	Richland, WA	S	Pac	73,369	3.2888
	Yakima, WA	S	Pac	79,435	3.4552
	Seattle, WA	L	Pac	250,376	3.4352
	Portland, OR	L	Pac	204,889	3.4508
	Eugene, OR	S	Pac	148,145	3.0841
	Redding, CA	S	Pac	81,508	3.5842
	Eureka, CA	S	Pac	53,033	2.8287
	San Francisco-Oakland-San Jose, CA	S	Pac	43,739	5.5525
	Sacramento, CA	S	Pac	135,731	4.5009

Area Number	Region	Size	Location	Employment
178	Stockton-Modesto, CA	S	Pac	81,951
179	Fresno-Bakersfield, CA	S	Pac	149,703
180	Los Angeles, CA	S	Pac	59,309
181	San Diego, CA@	S	Pac	45,247
182	Anchorage, AK@	S	Pac	120,879
183	Honolulu, HI	S	Pac	80,102

* S = Small

* L = Large Non-SMSA's are thoae with 1976 employment levels above 18

** Legend NE = Northeast

SE = Southeast

ENC = East North Central

WNC = West North Central

WSC = Weat South Central

Mtn = Mountain

Pac = Pacific

@ = areas excluded on the basis of atatistical consideration.

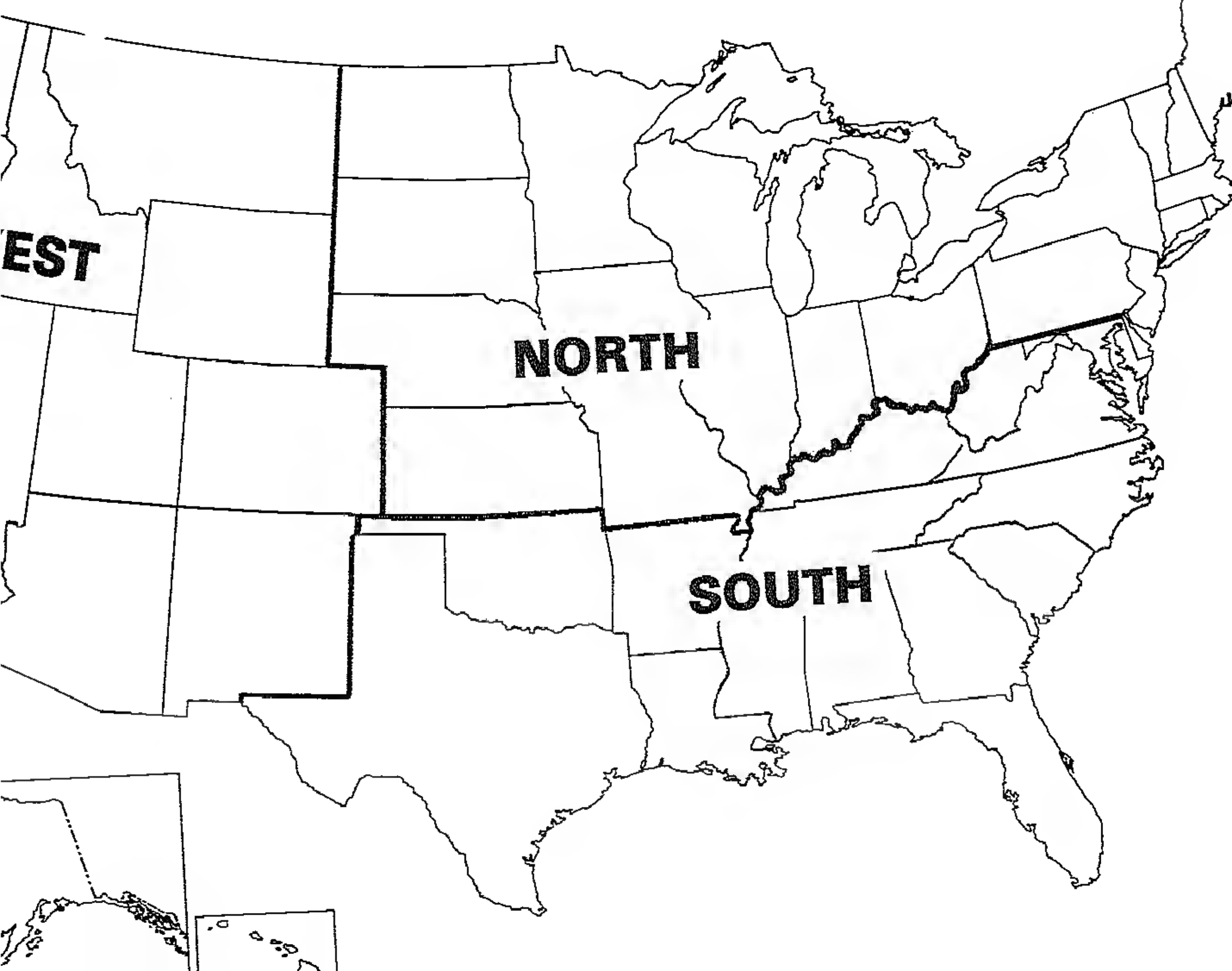
EST
NORTH
SOUTH

Figure E-2: Regions Delineated for Small SMSAs

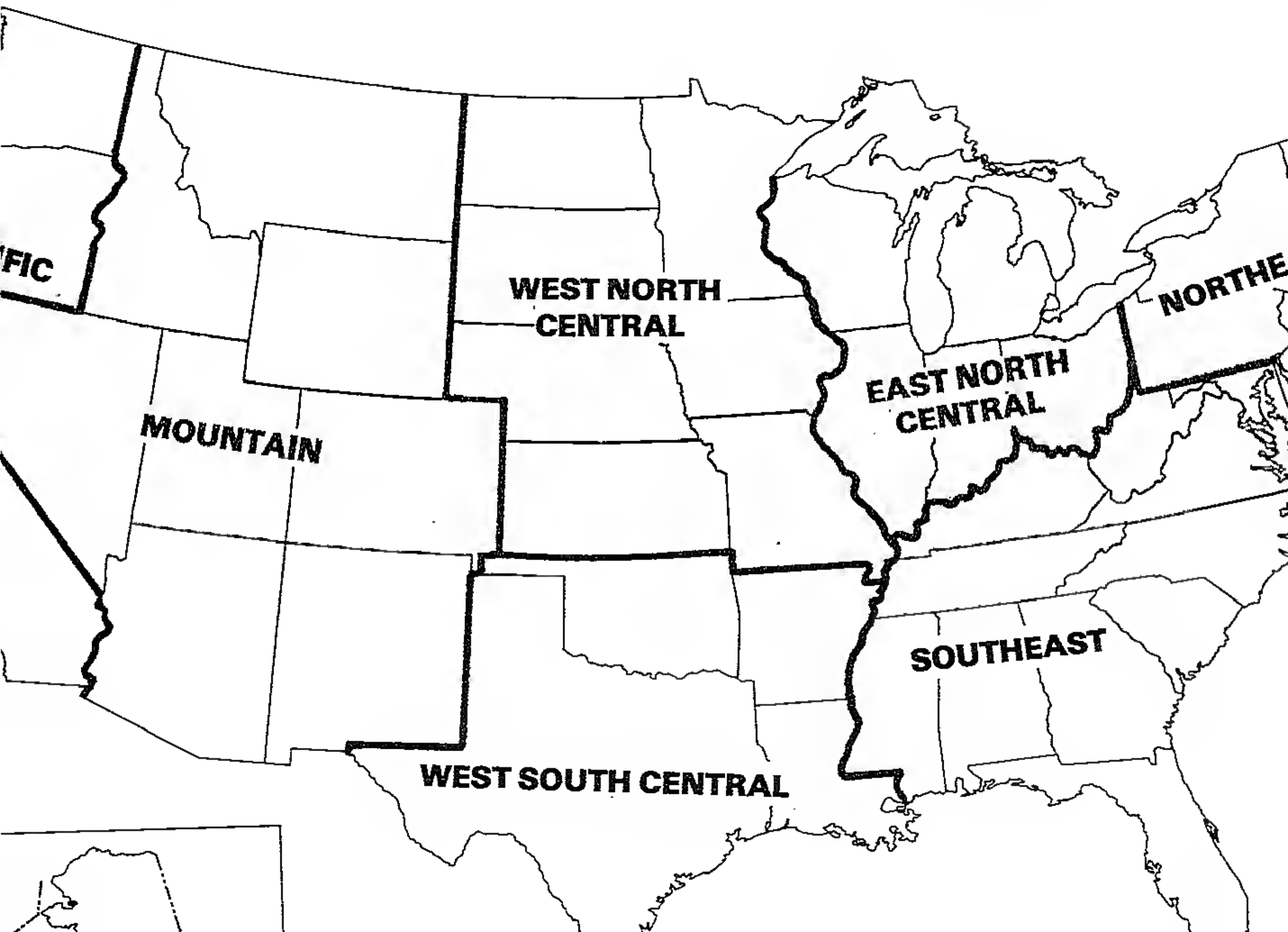

Figure E-3: Regions Delineated for Small Non-SMSAs